VOLUME 37
NUMBER 4

APRIL, 1950

plating

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PLATING ON PLASTICS

See Contents Page 363

"A new all purpose SOAKING CLEANER..."

CLEPO·135·H

CLEPO-135-H COMPOUND is used on

ALUMINUM and ZINC-BASE DIE CASTINGS

To remove oil and loosen buffing compounds without etching.

COPPER and BRASS

To remove oil and loosen buffing compounds without tarnishing.

STEEL and STAINLESS STEEL

To remove buffing compounds, grease, emery, sulphurized oil and drawing compounds.

If the parts being cleaned are to be plated, it is necessary to follow the CLEPO-135-H soak with a suitable CLEPO electrocleaner on Zinc-Base Die Castings, Copper, Brass and Steel.

A request on your company letterhead will bring to you the complete cleaning cycle we recommend for the particular metal you are cleaning, and the type of foreign matter to remove.

CLEPO CLEANING COMPOUNDS

FREDERICK GUMM Chemical Company Inc.

538 FOREST STREET, KEARNY, N. J.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 239.

Ve ations

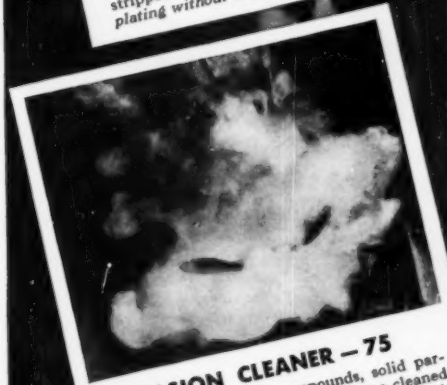
AL FINISHING . . .

METAL STRIPPER — A

An outstanding development for stripping defective electroplated nickel, copper, silver, cadmium and zinc from steel. Fast action . . . no basis metal attack. The highly polished grill cover illustrated has been completely stripped of nickelplate, and is *ready for replating without repolishing.*

EBONOL BLACKENING PROCESSES

Ebonol finishes are used to beautify a widely diversified list of superior quality products. Photo shows steel parts blackened with Ebonol-S and S-30; copper and brass with Ebonol-C; zinc with Ebonol-Z. U. S. Patents — 2,364,993, 2,460,896, 2,460,898.



EMULSION CLEANER — 75

Oils, greases, buffing compounds, solid particles, deep seated in steel parts are cleaned out and completely removed by this emulsification process. Stubborn, gummy substances on die castings, milling machines, floors, motor blocks emulsify and disperse in water instantly.

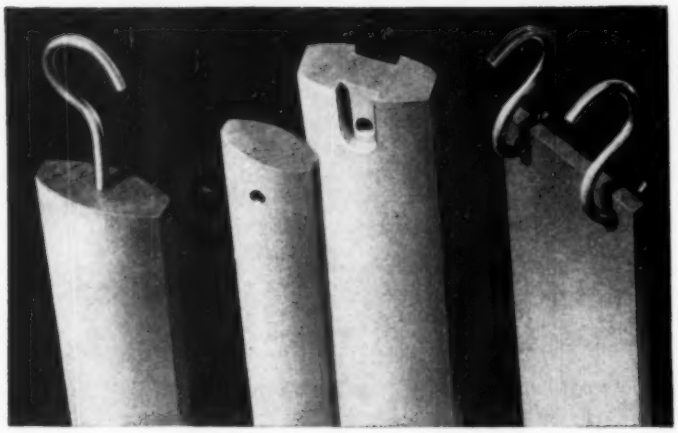
ENAMEL STRIPPERS

Enthone has over 20 strippers for removing organic finishes — synthetic enamels, lacquers, vinyls, japans. The best strippers, tailor-made for your particular problem, are selected by laboratory technicians after test runs. This service is rendered free of charge.

tion upon request.

Enthone Incorporated

ANACONDA
means purity in copper anodes



WHEN you specify ANACONDA, you are assured of unexcelled purity . . . less than 0.01 percent of total metallic impurities . . . an advantage that pays off five ways:

1. *Copper goes into solution faster and more uniformly.*
2. *The highest quality deposit is produced in the shortest possible time.*
3. *Slime is reduced to an absolute minimum.*
4. *Spotting and discoloration of the deposit are minimized.*
5. *Scrap losses are exceptionally low.*

In addition to copper, ANACONDA Anodes are furnished in brass and bronze . . . rolled sheet or oval . . . cut to your own specifications or standard sizes . . . drilled or undrilled . . . with or without hooks—also copper "cathode-anodes". For present or future reference, write for Publication C-5, The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

for Plating with Copper, Brass or Bronze

Use ANACONDA Anodes

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 241.

Industry News

The Prozite Company, a Michigan Corporation recently formed by **Poor & Company** of Chicago and **Calumet and Hecla Consolidated Company,** Calumet, Mich., will manufacture in Calumet a line of metal finishing compositions, using a new abrasive material mined at Calumet and new series of brass and lubricants. The new abrasive is said to replace Tripoli. Research Laboratories are located in Waukeegan, Ill. **Gerity-Michigan Corporation,** Adrian, Mich., has been appointed exclusive national sales agent for the polishing and buffing compositions.

Circo Products Company has opened new general offices at 6531 Euclid Avenue, Cleveland 3, Ohio. Due to the unrelated methods of manufacture of its two major cleaning-equipment lines, the company will operate its main plant at 1965 E. 66th Street in Cleveland for the manufacture and servicing of its Dee Tee equipment. Manufacturing facilities have been secured on the West Side of the city for the breaking, welding, and complete assembly of the large degreasers for all types of metal cleaning.

Rapid Electric Company, 2847 Middletown Road, Bronx 61, N. Y., manufacturer of selenium rectifiers and PR units, announces that it has retained the consulting services of **Henry Levine & Son, Inc.,** Forest Hills, N. Y., long established metal finishing consultants well known in the East. This association will enable the Rapid Electric Company to offer free consulting service to its customers.

Udylite Appointed Tank Magnet Distributors. Appointment of the Udylite Corporation, Detroit 11, as national distributor for Rotary Tank Magnetools is announced by the manufacturer, **Multi-finish Manufacturing Company,** 2114 Monroe Avenue, Dept. 484, Detroit 7, Mich.

In Udylite's initial sales program the new D-Series of three sizes of Tank Magnetools will be offered. Improvements in this series include increased capacity, stronger and more durable Neoprene wheels, a better wiper ring, and a stronger frame assembly.

University Microfilms announces a program for filming periodicals. One of the most pressing problems facing libraries today is to provide adequate storage space. Periodicals give particular difficulty because of number and bulk. A

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Copyright, 1950, by the American Electroplaters' Society, Inc. Subscriptions: Domestic and Canada, $4.00 per year, 50c per copy; Foreign, $6.00 per year, 75c per copy.

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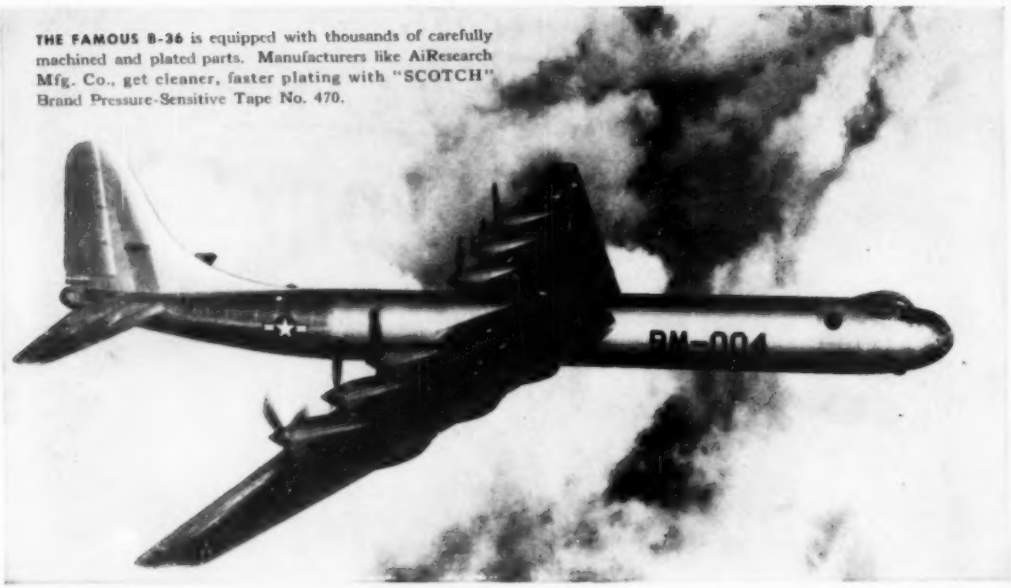

THE FAMOUS B-36 is equipped with thousands of carefully machined and plated parts. Manufacturers like AiResearch Mfg. Co., get cleaner, faster plating with "SCOTCH" Brand Pressure-Sensitive Tape No. 470.

MASKING unfinished actuator gears before painting and plating. Tape withstands acid, alkali, water, alcohol, hydrocarbons, heat or cold; stands up even in hard chrome, remains pliable under long submersion.

How B-36 parts are plated faster

Masking with tough new plastic tape gives accurate, dependable results

Plating parts for the giant B-36 calls for fast, precision workmanship. That's why AiResearch Mfg. Co., Los Angeles, Calif. masks with plastic-backed "SCOTCH" Pressure-Sensitive Tape No. 470. Speed of tape application and removal has boosted production, lowered costs.

You can depend on this tape to cut your plating time, to increase plating efficiency. Here's an electroplating tape designed for practically every job in your shop.

Address: Minnesota Mining & Mfg. Co., St. Paul 6, Minn.

☐ Please send me a sample roll of "SCOTCH" Brand Pressure-Sensitive Tape No. 470 for testing purposes.

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P-4

MAIL COUPON TODAY. Give this amazing new tape a try in your own shop. Compare it. Test its performance under actual conditions. You'll see why "SCOTCH" Pressure-Sensitive Tapes are the choice of more and more experienced manufacturers and electroplaters. There's no obligation, of course.

Made in U. S. A. by **MINNESOTA MINING & MFG. CO.,** St. Paul 6, Minn.
also makers of other "Scotch" Brand Pressure-Sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives.
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WANT TO *Cut* PLATING COSTS?

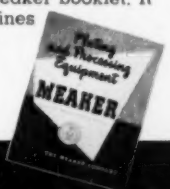
A 91-foot Meaker Automatic Machine with 17 sequences.

Get Results with a MEAKER PLATING MACHINE

You save three ways with a Meaker plating machine. In many cases the savings in labor costs, space, and chemicals alone have paid for the Meaker equipment in a very short time. Increased production is a natural result. A better and more uniform plating job is assured. Furthermore, cleaner and more agreeable working conditions reduce personnel turnover to a minimum.

A Meaker machine makes every operation in the plating sequence automatic, or as mechanized as possible. It is the profitable way to do electroplating on a competitive basis. Large percentage savings have been the rule both in the plating departments with medium output and in the mass production plants.

Look to the handling methods in your plating work. There may be an opportunity to save a lot of money. Whatever your requirements call for—full automatic, semi-automatic, or a special machine—Meaker has the answer. Get the Meaker booklet. It shows actual installation photographs of machines that have reduced operating costs for others—these machines can do the same for you.



Ask for Booklet No. 148

MEAKER PRODUCTS

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solution to this problem is possible through the proper use of microfilm. The procedure can be made as follows:

1. The library subscribes to the regular edition of a journal.

2. A subscription is also placed with University Microfilms for a microfilm copy to be delivered at the end of the volume year (i. e., all of 1949 during the first part of 1950). The cost of the film copy will be approximately equal to the binding costs of the same material.

3. The original paper copies are used in the library, unbound, until the period of greatest use is over, or until these copies are worn out. At this time the paper copies are discarded or disposed of and the microfilm copy is substituted.

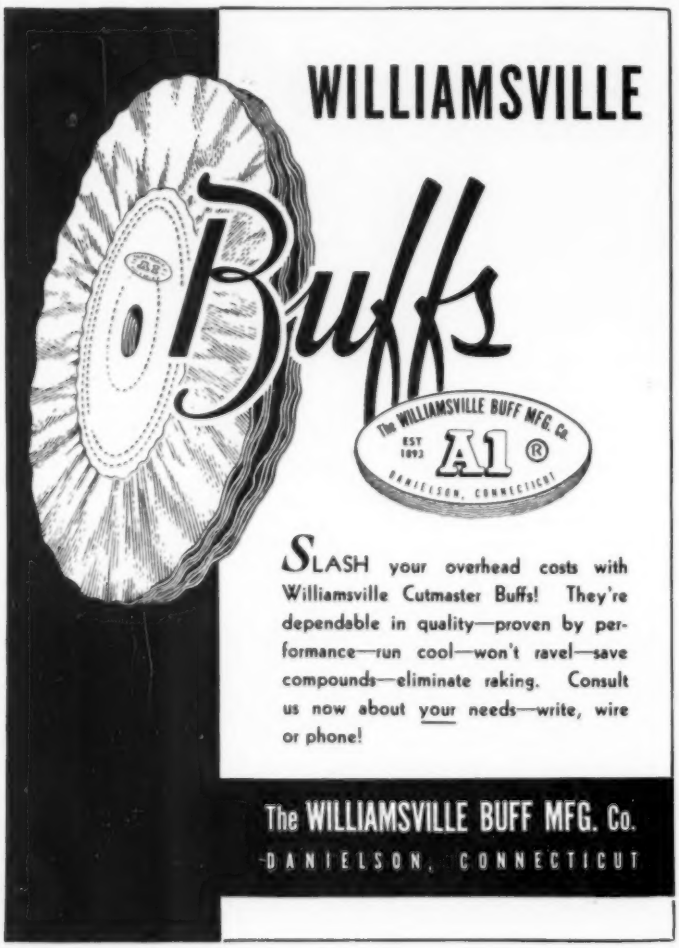
Since the cost of the film is roughly equal to the binding cost which would be spent on the paper copies, no additional expense is incurred in acquiring the film. Use of microfilm in this way can save 94 per cent of the storage costs of the paper edition.

Among periodicals which University Microfilms now offers are: Automotive Industries, Chemical and Metallurgical Engineering, Chemical Reviews, Chemist, Engineering and Mining Journal, Engineering News-Record, Factory Management and Maintenance, Journal of Physical and Colloid Chemistry, Metal Progress, and PLATING.

The Water Pollution Control Advisory Board at its January 10–11 meeting in Cincinnati, Ohio, adopted a proposal by Public Health Service officials to form a National Technical Task Committee on industrial waste. This committee will act as a coordinating agency for a number of major industrial groups composed of industries having allied interests. Each group would consist of representatives from individual industries.

Functions of the task committee will include: inventorying, appraising, coordinating and promoting research and developmental work on treatment and control of industrial wastes; stimulating close working relations on technical phases with industry and with Federal, State, and local governmental agencies; maintaining a steady output of information on progress made in industrial waste-pollution control and keeping in close touch with technical, professional, and trade associations issuing publications reaching persons concerned with water pollution problems.

Among Board members present were L. A. Danse, General Motors Corporation, Detroit, Mich.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SLASH your overhead costs with Williamsville Cutmaster Buffs! They're dependable in quality—proven by performance—run cool—won't ravel—save compounds—eliminate raking. Consult us now about your needs—write, wire or phone!
The WILLIAMSVILLE BUFF MFG. Co.
DANIELSON, CONNECTICUT

American Air Filter Company, Inc., Louisville, Ky., manufacturers of air filters and dust collectors, and **Herman Nelson Corporation**, Moline, Ill., one of the oldest names in heating and ventilating equipment, completed their merger on January 6.

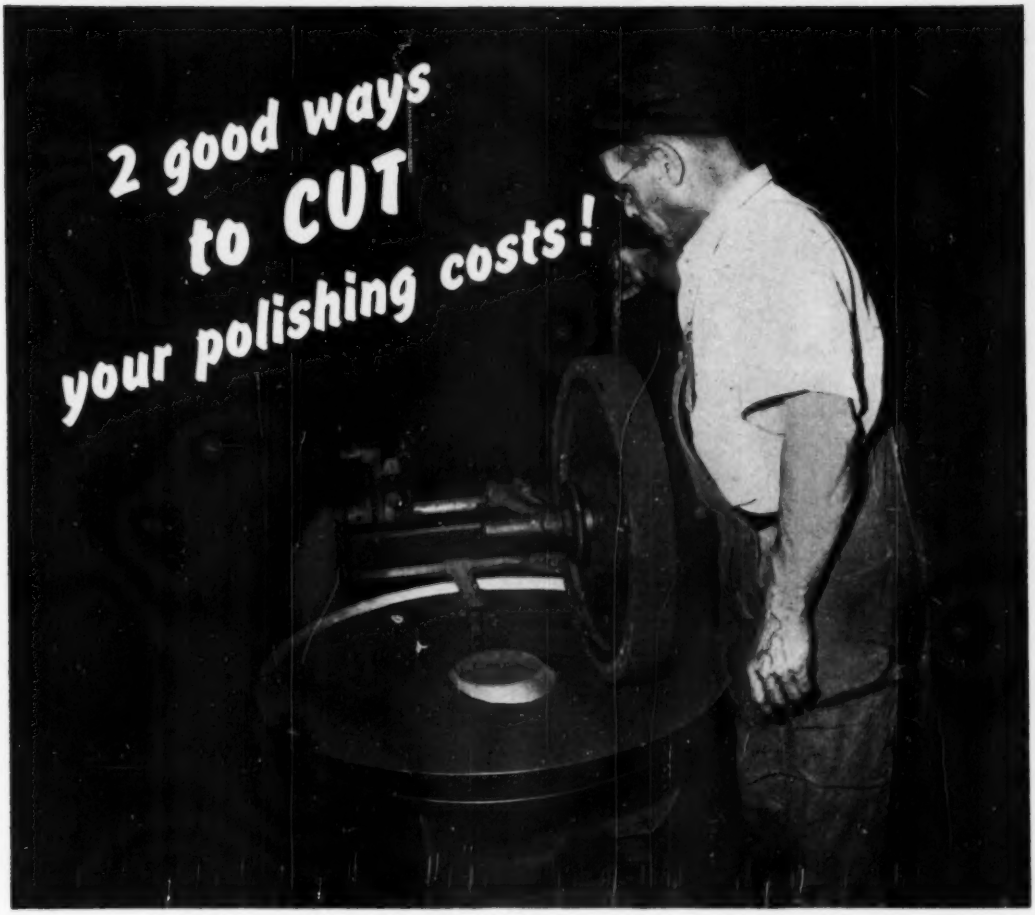
The Nelson Corporation henceforth will be operated as the Herman Nelson Division of American Air Filter Company, Inc., and will continue to maintain its headquarters and facilities in Moline. The merger company's principal offices and headquarters will be in Louisville, Ky.

W. G. Frank, Executive Vice-President and Richard H. Nelson have been elected directors, Richard H. Nelson and Robert W. Nelson Vice-Presidents, and E. G. Mason Assistant Secretary and Assistant Treasurer.

The Chemicals Division of The Glenn L. Martin Company has been purchased by **United States Rubber Company** according to a joint announcement by the two companies. The rubber company will acquire all assets of the division, including the Marvinol vinyl-resin plant at Painesville, Ohio; laboratory equipment in Baltimore; patents; and the trade name of Marvinol. The business will become a part of the Naugatuck Chemical Division of the rubber company. The Painesville plant will continue to make Marvinol vinyl resin for sale to manufacturers of plastic products.

Through the sale of its Chemicals division, the Martin Company completes its program of concentration in the aviation field by divesting itself of all interests not directly concerned with the manufacture of airframes, special weapons, and closely related products.

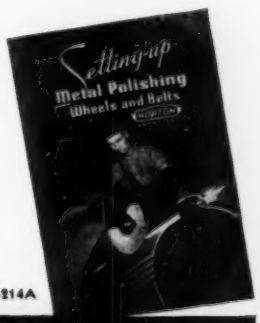
G. E. Organizes St. Louis Sales District. A new General Electric apparatus sales district, twelfth in the nationwide G-E Apparatus Department sales system, was established March 1.



(1) Take advantage of these cost-cutting features of Norton ALUNDUM Polishing Abrasive: its extreme hardness and toughness; its uniformity of chemical composition and crystal structure; its uniform grain size; its high capillarity; its variety of shapes and types of surface treatments.

(2) Take advantage of the many helpful tips on polishing and setting-up metal polishing wheels and belts offered in this interesting 44-page Norton booklet. Send for your free copy—no obligation of course.

This illustration of a glued wheel being rolled automatically is typical of the many helpful pictures shown in the booklet described below.



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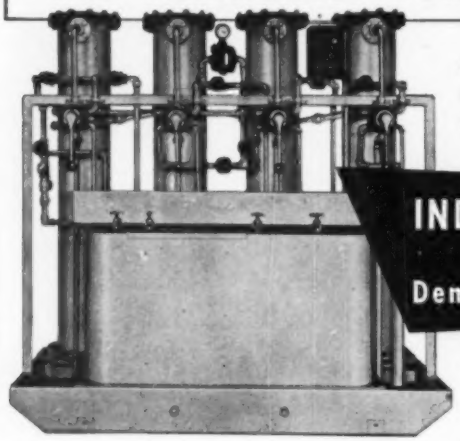
NORTON ABRASIVES

Eliminate Hot-Rinse Stains Unwanted Precipitates

USE CHEMICALLY PURE WATER



only a few cents a thousand gallons *with . . . .*

INDUSTRIAL Water Demineralizers

A four-bed Industrial Water Demineralizer. Standard two- and four-bed units available with capacities of 200 to 1000 gph. Special units of any capacity —engineered to requirements.

and it's as simple as it looks . . .

besides the extremely low cost, there is nothing complicated about getting the chemically pure water with Industrial Demineralizers. Raw water is passed through either two or four beds of ion-exchange resins and it comes out free of the dissolved mineral salts. No still, heat, steam, or cooling water is needed—keeping space requirements relatively small.

And it's simple to get the complete facts for your case. Send us a water analysis and let us know how much water you have to treat and the gallons per hour needed. We can then give you the whole demineralizer story including estimated costs, equipment required, performance data, etc. for your requirements.

for solution clarification . . .

use an **INDUSTRIAL Filter**

100 to 15,000 gallons per hour. Portable and stationary models. Standard or special filtration systems engineered to meet unusual requirements.

Write for full information and recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

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RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

Industry News

G. F. Maughmer, formerly Manager of the G-E sales office at Los Angeles, has been appointed to head the new organization. The new district consists of all sales areas presently in the company's St. Louis, Kansas City, and Omaha territories.

Practical Electroplating is the name of a State University extension course at Massachusetts Institute of Technology, sponsored by Massachusetts Department of Education, Division of University Extension, 200 Newbury Street, Boston 16, Mass.

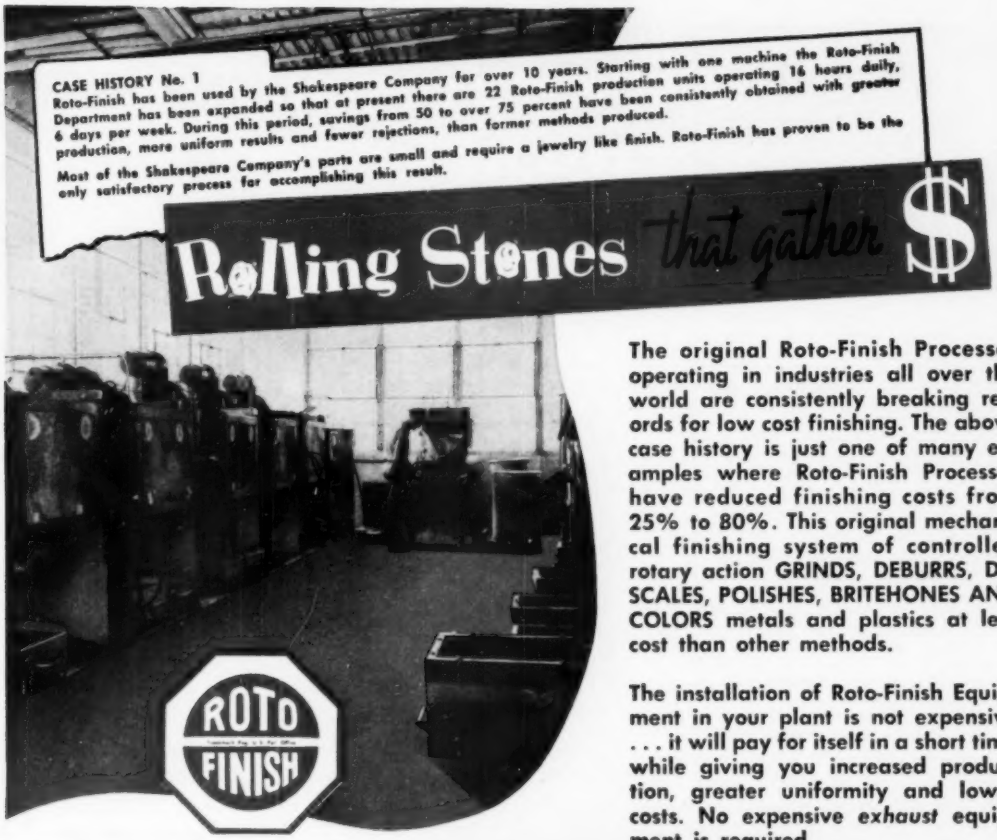
This course, conducted once a week at night, is especially designed for those who have completed "Introduction to Electroplating" or who have an elementary knowledge of chemistry and electrochemistry. Topics discussed will include the controlling factors in electroplating; the types of equipment and methods used for electroplating; and the plating baths and techniques in use for the deposition of cadmium, copper, chromium, nickel, tin, zinc, silver, gold, and other metals commonly electroplated. The instructor is Leonard Chesworth, Chief Chemist, United Carr-Fastener Corporation.

Organic Finishing. The 1950 Spring Term, offering two different courses in Surface Technology, started at New York University in the second week of February and will end during the month of May. Classes are held in the evening, one day a week.

One course, which takes up "Fundamentals of Paint, Varnish and Lacquer Technology", is taught by Elias Singer. The other course is called "The Technology of Organic Finishes and Their Applications", and is taught by Myron A. Coler. For further information, write Division of General Education, New York University, 3 Washington Square North, New York 3, N. Y.

Magnus Conducts Regional Conferences. The second of a series of six regional Technical Sales Conferences for the field service representatives of the Magnus Chemical Company, Inc., was held at the Park Hotel, Plainfield, N. J., on February 16 and 17. It was attended by the Magnus representatives in the Middle Atlantic States.

The sessions were conducted by Dave Blanchard, Vice-President in Charge of Sales, and were devoted to papers discussing the latest developments in modern methods of cleaning in the many and varied industries serviced by the Company. The discussion was highlighted by a report given by Dr. R. W. Mitchell, Technical Director, in which he introduced several new products developed as a result of extensive research in the Magnus Laboratory.



CASE HISTORY No. 1

Roto-Finish has been used by the Shakespeare Company for over 10 years. Starting with one machine the Roto-Finish Department has been expanded so that at present there are 22 Roto-Finish production units operating 16 hours daily, 6 days per week. During this period, savings from 50 to over 75 percent have been consistently obtained with greater production, more uniform results and fewer rejections, than former methods produced.

Most of the Shakespeare Company's parts are small and require a jewelry like finish. Roto-Finish has proven to be the only satisfactory process for accomplishing this result.

Rolling Stones *that gather* $

The original Roto-Finish Processes operating in industries all over the world are consistently breaking records for low cost finishing. The above case history is just one of many examples where Roto-Finish Processes have reduced finishing costs from 25% to 80%. This original mechanical finishing system of controlled rotary action GRINDS, DEBURRS, DESCALES, POLISHES, BRITEHONES AND COLORS metals and plastics at less cost than other methods.

The installation of Roto-Finish Equipment in your plant is not expensive . . . it will pay for itself in a short time while giving you increased production, greater uniformity and lower costs. No expensive *exhaust* equipment is required.

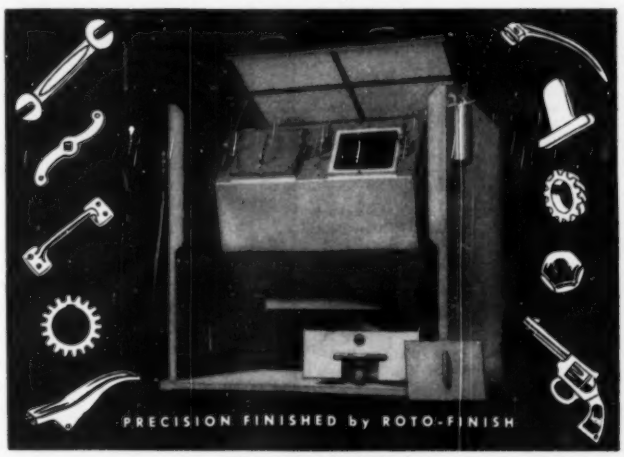
ECONOMICAL DEBURRING

Roto-Finish Deburring—Grinding—Descaling Processes will reduce manufacturing costs and give you uniformly deburred parts. These engineered Processes remove burrs, corners, sharp edges, parting line flash and heat treating scale, at lowered cost. These processes are used for stress relieving and improving the fatigue life of spring type parts.

Make Us Prove It!

SEND US YOUR SAMPLES

The facilities of our Sample Processing Department are at *your service*. Send us a sample lot of your parts for finishing (include finished part for guide). Roto-Finish will process your parts — prepare a report which will then be returned to you with the finished parts —at no cost or obligation. Write today for complete information on Roto-Finish.



(Above — Model DW 45-2)

Roto-Finish COMPANY KALAMAZOO, MICH.

ORIGINATORS OF THE ROTO-FINISH PROCESSES

FOREIGN REPRESENTATIVES: London, England—Roto-Finish Ltd., 32 Bishopsgate • Den Haag, Holland—N. V. Roto-Finish Maatschappij—Voor Benelux • Zurich, Switzerland—Kay-Zurich • Melbourne, Australia—A. Flavell Pty. Ltd. • Windsor, Canada—Roto-Finish Canada Ltd. • Rio de Janeiro, Brasil—Commercial E Industrial de Farnos Werco, Ltda. • Frankfurt A.M., Germany—Metallgesellschaaft A.G. • Milan, Italy—Societa' Roto-Finish A.R.I.

AVAILABLE FOR IMMEDIATE SHIPMENT ATTRACTIVE VALUES

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS, WITH FULL CONTROL EQUIPMENT:

1—15,000/7500 AMPERE, 6/12 VOLT **COLUMBIA ELECTRIC CO.** with Separate M. G. Exciter.

1—10,000/5000 AMPERE, 6/12 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Separately Excited. Synchronous Motor. Excellent Condition.

2—7500/3750 AMPERE, 8/16 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Separately Excited. Synchronous Motor.

1—5000/2500 AMPERE, 6/12 VOLT **MUNNING** "OPTIMUS." Separately Excited.

1—3000/1500 AMPERE, 6/12 VOLT **CHANDEYSSON ELECTRIC CO.** Synchronous Motor. Exciter-in-Head.

1—3000/1500 AMPERE, 6/12 VOLT **ELECTRIC PRODUCTS CO.** Synchronous Motor. Separately Excited.

1—2000/1000 AMPERE, 12/24 VOLT **HANSON-VAN WINKLE-MUNNING.** Separately Excited.

1—1500/750 AMPERE, 6/12 VOLT **HANSON-VAN WINKLE-MUNNING.** Shunt Wound. Separately Excited.

3—1250 AMPERE, 15 VOLT **COLUMBIA ELECTRIC CO.** Exciter-in-Head.

2—1000/500 AMPERE, 6/12 VOLT **CHARLES J. BOGUE ELECTRIC CO.** Separately Excited. Interpole Design. Exciter-in-Head.

1—750 AMPERE, 12 VOLT **CHANDEYSSON ELECTRIC CO.** Synchronous Motor. Exciter-in-Head.

1—1500 AMPERE, 40 VOLT **HANSON-VAN WINKLE-MUNNING** Anodizing Synchronous MG Set. Automatic Controls. Exciter-in-Head.

1—1000 AMPERE, 40 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Anodizing Synchronous MG Set. Exciter-in-Head.

1—1000 AMPERE, 25 VOLT **HANSON-VAN WINKLE-MUNNING CO.** Separately Excited. Anodizing Unit.

OTHER SIZES OF ELECTROPLATING AND ANODIZING MOTOR GENERATOR SETS IN STOCK.

4—**G. E.** COPPER OXIDE RECTIFIER, 500 AMPERE, 6 VOLTS, for operation on 220/3/60.

3—**HANSON-VAN WINKLE-MUNNING** COPPER OXIDE RECTIFIERS, 500 AMPERES, 6 VOLTS, with 220/440 volt, 3 phase, 60 cycle input. **SPECIAL . . .**

3—**DIVINE BROS.** BUFFING LATHES, **NEW,** 7½ HP, 220/3/60/2800 RPM. PRICED RIGHT.

M. E. BAKER CO.
25 WHEELERSTREET
CAMBRIDGE, MASS.

Industry News

A similar conference was held on January 26 and 27 in Boston for the Magnus representatives in the New England States. Additional conferences are scheduled for Chicago, Cleveland, Atlanta and Tulsa this spring.

Zapon Sales Meeting. An exhibit of more than 150 products made by nationally known manufacturers and finished with Zapon products was featured at two-day sales conferences held at the Stamford, Conn., and North Chicago, Ill., branches of the Atlas Powder Company's Industrial Finishes Department.

North Chicago salesmen and sales engineers gathered at the Deerpath Inn, Lake Forest, Ill., for their meeting under the direction of Roy T. Riggs, sales manager. The eastern sales force met at the Roger Smith Hotel, Stamford, for their sessions, which were in charge of Sales Manager W. G. Sheane. Discussed at the meetings were new developments in air-dry and bake synthetics for metal fabricators.

Spray Finishing Consultation. Binks Manufacturing Company, 3122 Carroll Avenue, Chicago 12, Ill., invites manufacturers to send in samples of their products for trial finishing. Without obligation, Binks will determine in its new Customers' Research Department whether or not the

product can be finished automatically. The manufacturer will be given a report showing the production and cost which can be expected based upon actual test.

Included in the Department is an automatic reciprocating machine for finishing flat products—everything from tea tiles to table tops—and an automatic spindle machine (shown here) for finishing round, cylindrical, or many-sided products. Such parts are spun in front of spray guns. Various adaptations of these machines make possible the finishing of a wide range of articles.

Instrument Course. April 10 to 14, inclusive, is the period of the second quarterly instrumentation course for 1950 conducted by the Fischer & Porter Company at its Hatboro, Pa., plant. Manufacture, calibration, installation, opera-

FASTER, BETTER FINISHING with *HARRISON'S NEW*

4A

BUFFING AND POLISHING COMPOUNDS

You send us sample of metal used. We will return finished sample together with compound for your specific requirements.

Speed up production with correct compositions.

HARRISON & COMPANY
Incorporated
HAVERHILL, MASSACHUSETTS

"Tests prove there's none better-- figures show it costs you least"

*Special trial order packaging

Exhaustive tests have proved that ARP #3 zinc plate brightener in barrel, still or automatic zinc plating gives you increased brightening range and a smooth, controllable, bright deposit of zinc second to none. The price of ARP #3 is well below that of any other zinc brightener of even satisfactory quality. The ease of handling and flexibility of operation reduce operating costs to make additional savings for you. For your own satisfaction, ask your Allied representative for full information and comparative cost breakdown . . . or, write for literature and 10 lb. trial order.

Use ARP #3 Plus IRIDITE® Bright For A *Lasting* Finish

For a lasting, brilliant and lustrous finish—combined with corrosion resistance—use Iridite Bright after bright zinc plating. This chromate-type finish requires only a simple dip—no heating, non-electrolytic—is efficient and inexpensive. Ask your Iridite representative.

ALLIED RESEARCH PRODUCTS, INC.
4004 EAST MONUMENT STREET
BALTIMORE 5, MD.

Manufacturers of IRIDITE Finishes for Corrosion Resistance and Paint Systems for Non-Ferrous Metals: ARP Plating Chemicals

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 251.

Industry News

tion and maintenance of the company's line of process control instruments will be covered. Additional information can be obtained by writing to the Fischer & Porter Company, East County Line Road, Hatboro, Pa.

Salt Spray Tests. The United States Testing Company, Inc., 1415 Park Avenue, Hoboken, N. J., announces the installation of a new salt-spray test cabinet, constructed to meet the requirements of Federal Specifications governing the inspection of metals.

The Du Bois Company, Cincinnati, Ohio, manufacturer of cleaning and processing compounds, has purchased the **Giant Products Company** of Los Angeles.

The 15-year-old Giant Company, with products generally parallel to those of the Du Bois Company, has operated chiefly west of the Rockies, with the bulk of its sales force in Southern California. Its modern plant occupies a full city block adjacent to downtown Los Angeles, with well-planned loading and shipping facilities.

The Du Bois Company operates nationally through an extensive network of field representatives and warehouses in all principal cities. This coming year marks its thirtieth anniversary. Its dual line of chemical products is well known in both institutional and industrial fields.

The Ferro Enamel Corporation, Cleveland, Ohio, announces transfer of the manufacturing and distributing rights of its complete line of Ferro Cleaning Compounds to **MacDermid, Inc.,** Waterbury, Conn. Ferro's decision to transfer the cleaning portion of its business to MacDermid was prompted by its desire to concentrate on the porcelain enameling field.

Ferro Metal Cleaning Compounds will be manufactured by MacDermid and sold through regular MacDermid distributors in the Midwest and Southern States and through MacDermid representatives in the Eastern States. However, Ferro Enamel will resell these cleaners exclusively to the porcelain enameling field. The West Coast will continue to be serviced by the Ferro Enamel Corporation of Los Angeles, Calif.

New Silicate Furnace in Operation. On January 23 the Diamond Alkali Company put into full-scale operation a new 50,000-ton furnace at its Cincinnati, Ohio, silicate plant. The addition of the new furnace will increase production of silicate of soda and related products at the Cincinnati plant by 50 per cent. The Cincinnati plant, which has E. J. Feighery as plant manager, is one of six silicate plants operated by Diamond.

Surface Alloys, Inc., is the new name of **Morey Electroplating Corporation,** 2972 E. Century Boulevard, Lynwood, Calif. There has been no change in personnel, policy or address. M. Schwartz, formerly of Standard Steel Spring Company, Coraopolis, Pa., is the plating engineer.

Is METAL PARTS CLEANING a bottleneck in your plant?

DEGREASERS

WASHERS

DRYERS

A complete line of OPTIMUS Equipment is available in standard and special sizes to meet every metal parts cleaning problem and allied processing applications.

OPTIMUS VAPOR DEGREASERS are available in all various types and stages, straight vapor, vapor-spray, liquid-vapor and combinations of these. All sizes from simple batch type degreasers to custom built monorail or cross rod conveyor models.

OPTIMUS METAL PARTS WASHERS — single or multiple stage — screw or conveyor, mesh belt or monorail types. Can be applied to a wide range of operations as well as the handling of rust preventatives and other coatings.

OPTIMUS DRYERS embody a specially designed system of directional air jets which assure spotless drying after plating or polishing and before subsequent painting, plating or lacquering.

Submit your metal parts cleaning problem to our engineering staff.

Distributors of
"Midsolv"
A Perchlorethylene Degreaser Solvent
"Triclene D"
A Trichlorethylene Degreaser Solvent

Send for complete catalog and additional information

OPTIMUS EQUIPMENT COMPANY
13 Water Street **Matawan, N. J.**
Offices in principal cities

OPTIMUS EQUIPMENT
FOR CLEANING · RINSING · DEGREASING · PICKLING AND DRYING OF METAL PARTS

SITUATION WANTED
ELECTROFORMING ENGINEER

Graduate Chemical Engineer with experience in making up, controlling, analyzing, and electroforming with iron, copper, nickel, and silver; and plating with gold, rhodium, palladium, platinum, chromium, etc., solutions for manufacturing phonograph record stamper matrices, radar wave guides, slosh molds, paint masks, parabolic mirrors, etc., is seeking an administrative position in or around North New Jersey or Metropolitan area.
Reply to:

P-450A, PLATING
P. O. Box 168, Jenkintown, Pa.

SALESMEN WANTED

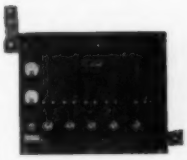
Manufacturer of Metal Parts Washers, Vapor Degreasers, Dryers, in sales expansion program, has several desirable territories open for experienced salesmen. Salary plus commission.

OPTIMUS EQUIPMENT COMPANY
Matawan, New Jersey

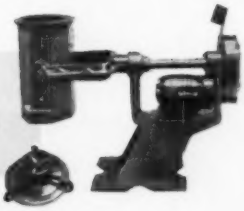
CROWN Equipment

Model 815 Selenium Rectifier

Crown Rheostat with Cut Out Switch

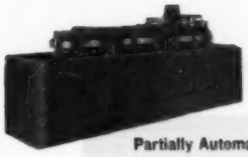


Crown Rheostat

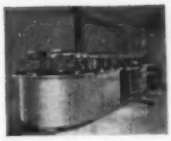


Ball Burnisher

Crown Tumble Finishing Machines

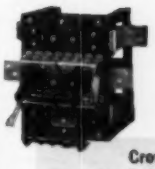


Partially Automatic



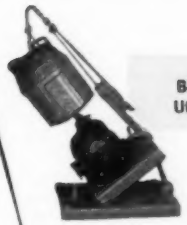
Fully Automatic Plating Machines

Centrifugal Drier



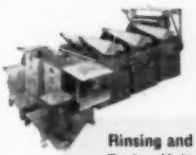
Crown Reversing Switch

Bottle Type Tumble Finishing Machine



Bench Type Utility Plater

Tilting Type Tumbler



Rinsing and Drying Unit

Crown Disconnect Switch

Plating Barrel

CROWN RHEOSTAT AND SUPPLY COMPANY

3465 NORTH KIMBALL AVENUE • CHICAGO 18, ILLINOIS

MECHANIZE YOUR PLATING DEPARTMENT

ELIMINATE REJECTS • IMPROVE QUALITY • REDUCE COSTS

Personals

Dudley B. Blake has been appointed General Sales Manager of United Lacquer Manufacturing Corporation, Linden N. J., and Everett, Mass., manufacturer of industrial finishes, synthetics and paints. He will supervise industrial-sales promotion and a national expansion program.

William A. Munkacsy has been elected President of Munray Products, Inc., sales division of the Poly-Cyclo Products Company, 12400 Crossburn Avenue, Cleveland, Ohio.

Mr. Munkacsy, who is also President of The Poly-Cyclo Products Company, succeeds **T. R. Gill** who recently resigned.

Ernest S. Kopecki recently joined the Pennsylvania Salt Manufacturing Company as a sales service representative in the Special Chemicals Department. Having earned his B.S. degree in Chemical Engineering at Marquette University and his Master's degree in Metallurgy at Carnegie Institute of Technology, Mr. Kopecki comes to Pennsalt with extensive experience in the field of metallurgy. During the war he served with the Navy's Bureau of Ordnance in Washington and was separated from service as a Lieutenant Commander. Since then and until joining Pennsalt he has been metallurgical editor of "Iron Age".

A. J. Emmerich has been appointed Sales Manager of the J. J. Siefen Company, Detroit, Mich. He was formerly salesman in the Detroit area and brings into the national picture his extensive experience with liquid buffing and polishing compounds.

Frank Virgil has been promoted from the Order Desk to Sales Representative for the Metal Finishing Division of the L. H. Butcher Company, Los Angeles. He has had many years' experience in the protective coating field.

Walter A. Bayer and **William F. Clemons** have been appointed to the Detroit district sales staff of The Udylite Corporation.

Mr. Bayer has been with the Estimating Department of The Udylite Corporation since 1946 and Mr. Clemons was a

Bayer **Clemons**

control chemist in the firm's laboratories for two years. Both men are native Detroiters. Mr. Bayer graduated from University of Detroit in 1942, and Mr. Clemons received his chemical engineering degree in 1948 from Lawrence Institute of Technology.

Wayne D. Staley, formerly New York District Manager for The Duriron Company, has been appointed General Sales Manager and will be located at the home office of the Company in Dayton, Ohio. In directing sales and advertising activities, he will replace **D. E. Jack,** who has resigned as Vice-President in Charge of Engineering and Sales.

R. F. Sharpe, former Manager of the Philadelphia office, has been appointed New York District Manager.

Ralph L. Watts, who was formerly Sales Engineer in New York, will be in charge of the Philadelphia office.

J. Ralph Macon has recently joined Pennsylvania Salt Manufacturing Company as an engineer in its Market Research Division. He was formerly associated with duPont's Electrochemicals Department. A native of Thomasville, Ga., Mr. Macon was graduated from Emory University in Atlanta in 1941. He is a member of the American Society for Metals.

Dr. H. P. Munger, who joined the staff of Battelle Memorial Institute in 1948, has now been appointed to coordinate its air-pollution-research activities. He re-

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NOW . . .
SPEEDIE
"Spray It" Tripoli
No. 2072
Liquid — just spray it on. Water soluble. Stays in suspension. Will not clog lines or nozzle. Job-proved!

SPEEDIE Tripoli Compositions have long been known as "always-uniform products" which provide maximum cleaning efficiency with minimum time and labor!

For brass plumbing fixtures and die castings, the old reliable No. 607 can't be beat! No. 431 is 100% saponifiable—it cuts and colors beautifully.

No. 1074 is unmatched for name plates, emblems, and aluminum. For buffing all non-ferrous metals there is No. 1639 which *readily emulsifies in hot water,* eliminating cleaners.

For further information on these quality, job-proved SPEEDIE Tripoli Compositions, and a free, handy Catalog-Reference Book for your polishing shop, write today!

Polishing Room Supplies and Equipment

BP **THE BUCKEYE PRODUCTS CO.**

7032 Vine Street Cincinnati 16, Ohio

Cable address: Buckprod

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 254.

Personals

ceived his B.S. in Ch.E. from Georgia Institute of Technology, his M.A. in Ch.E. from Columbia University, and his Ph.D. in Phys. Ch. from University of Pittsburgh, and has been successively connected with Mellon Institute, Armco Corporation, Republic Steel Company, Van der Horst Corporation, and Youngstown Sheet and Tube Company.

Guy A. Baker has been appointed Vice-President in Charge of Manufacturing and **R. Merton Shields,** Secretary of the Durion Company, Inc., Dayton, Ohio.

For several years Mr. Baker has been

Baker **Shields**

Assistant to the President and Secretary of the Company. Prior to that he has been Manager of the Company's Alloy Castings Sales. During his twenty years with the Company, Mr. Baker has been active in metallurgical research and development.

Mr. Shields is a Mechanical Engineer, a graduate of Michigan College of Mining and Technology. He has been with the Company since 1936 and prior to his appointment was Manager of Dayton District Sales.

James H. Binger has been elected Vice-President and General Manager of the Belfield Valve Division (Philadelphia) of Minneapolis-Honeywell Regulator Company.

A native of St. Paul, Minn., and a 1941 graduate of the University of Minnesota Law School, Binger joined Honeywell in 1943 as Administrative Assistant in the Aeronautical Division and in December of 1945 was elected Assistant Secretary of the company. Two years later he was made Assistant Vice-President and was transferred to the sales department, a position he held until his latest promotion.

John F. Black has announced his resignation as President and Director of Circo Products Company, Cleveland, Ohio, at a board meeting on January 13.

Joseph W. Powell, Jr., Vice-President of the American Research and Development Corporation of Boston, was elected President of Circo at the same meeting.

Saran rubber, developed by The Dow Chemical Company, leads the way to cutting corrosion costs to a minimum. The extremely high degree of chemical and abrasive resistance, found in saran rubber, makes it the outstanding tank lining where the storage and conveyance of grease, solvents, acids or other chemicals is indicated.

Saran rubber can be applied easily and economically by experienced tank lining applicators located strategically throughout the country. Saran rubber lined pipe is available also—8 inch diameters and larger, and up to 20 feet in length.

Get in touch with an applicator today by contacting your nearest Saran Lined Pipe Company office—find out how you can add many years to the life of your costly equipment. Write: Dept. TSP-80.

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Offices in: New York • Boston • Philadelphia • Pittsburgh
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SARAN RUBBER
a
DOW
product

Personals

and **Fenton M. Davison**, Vice-President was placed in charge of all operations of the Company.

Dr. Irving Langmuir, world-famous scientist, retired at the beginning of the year from his position as Associate Director of Research for the General Electric Company but will continue work in the laboratory in a consulting capacity. He will engage primarily in activities of Project Cirrus, joint weather-research program of the U. S. Army Signal Corps and the Office of Naval Research in consultation with the General Electric Company.

During his 40-year career at General Electric, Dr. Langmuir's researches have saved the American public nearly one billion dollars per year in electric light bills, have helped make possible modern radio broadcasting, have given birth to new industries, have helped safeguard the

Langmuir

lives of soldiers in battle, and, more recently, have provided man a key to possible control of the weather.

His contribution to pure scientific knowledge, though little known to the layman, are considered of equal importance. His studies on electron emission and on gaseous discharges are regarded as classic in science. His experimentation with oil films on water uncovered an entirely new branch of chemistry, known as two-dimensional or surface chemistry, in which phenomena are found entirely different from any known before. Experimental techniques he developed for studying proteins, which furnished a new and powerful attack on fundamental problems of the functions of the human organism, are now being used by biochemists and biophysicists throughout the world. For his works, Dr. Langmuir has received the world's top-ranking scientific awards, including the Nobel Prize in chemistry granted him in 1932.

Curtis Miller is now Technical Representative of R. O. Hull & Company, Inc., Cleveland, Ohio. Since graduation in chemical engineering from Case Institute of Technology, he has been connected

Miller

with United Chromium, Inc., The McGean Chemical Company, and Chromium Corporation of America. During the last war, he served four years with the Army Chemical Corps as a Technical Officer. He will serve the northeastern Midwest.

K. R. Knoblauch has been named manager of sales of valve products for the industrial division of Minneapolis-Honeywell Regulator Company. He joined Brown Instruments Division of the company in 1924 as an engineer. In 1939 he was made Assistant Sales Manager of the Industrial Division, the headquarters of which are in Philadelphia. Four years later he was placed in charge of market extension and sales promotion. He will continue to make his headquarters at the Brown plant.

J. Robert Bunch has been appointed Sales Representative to assist J. D. Alexander in the Cleveland sales office of American Wheelabrator and Equipment Corporation, Mishawaka, Ind.

William F. MacDonald was elected President of E. F. Houghton & Company, at the annual stockholders' meeting recently held at the company's main offices in Philadelphia, Pa. Mr. MacDonald, who will temporarily continue to hold

Since the days of the Tandem Bike...
BLAKESLEE
HAS PIONEERED
METAL PARTS WASHERS
In the days when handle bar mustaches, derby hats and celluloid collars were popular . . . Metal parts were already being washed in Blakeslee washers.
Blakeslee engineers are constantly improving cleaning methods and speeding up cleaning operations to keep pace with modern mass production methods. Experience in handling every metal piece, from small watch parts to Diesel engine crank cases, has given Blakeslee engineers the "know how" to solve your particular cleaning problems.
A qualified Blakeslee representative is located near your plant. Write, wire or phone and he will be pleased to discuss your cleaning problems with you.
FOR WASHERS OR SOLVENT VAPOR DEGREASERS BLAKESLEE HAS THE ANSWER
G. S. BLAKESLEE & CO.
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NEW YORK, N. Y. TORONTO, ONT.
BLACOSOLV
DEGREASERS AND SOLVENT
NIAGARA
METAL PARTS WASHERS

Federated ANODES

for the Plating Trade

COPPER Anodes . . . M-Sterling Chill-formed in flat, oval, wedge, and ball shapes. Open mold shapes also available. All of prime electrolytic copper.

COPPER Anodes . . . electro-deposited, in all standard sizes . . . special sizes to order.

LEAD Anodes . . . the M-Sterling Dated Conducta-Core Anode with specially designed strong hooks coated to protect against acid fumes and spray.

TIN Anodes . . . flat and oval shapes . . . all standard sizes . . . made only of extra high purity tin.

ZINC Anodes . . . only of Special High Grade zinc in all standard sizes and shapes.

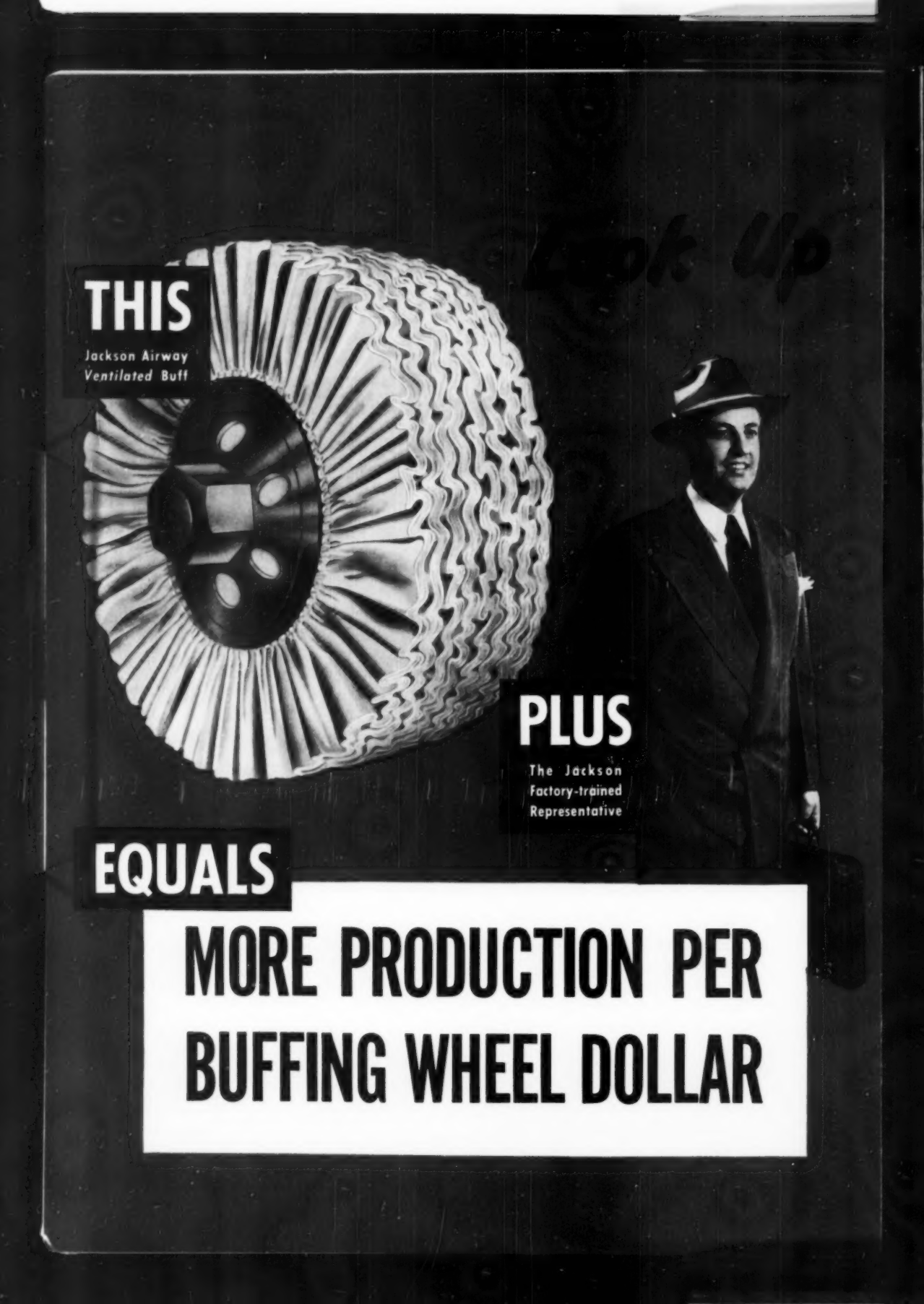
BRASS Anodes . . . full range of analyses . . . flat, oval, wedge, and ball shapes.

Federated Anodes are sold through offices in 22 principal cities. Quality is continuously controlled by Federated metallurgists so that the anodes are free of gates, flash, and cavities . . . of high chemical purity . . . to give uniform plating performance.

Write, wire, or phone for complete information

Federated Metals Division

American Smelting and Refining Company, 120 Broadway, New York 5, New York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Jackson Airway
Ventilated Buff
PLUS
The Jackson
Factory-trained
Representative
EQUALS
MORE PRODUCTION PER
BUFFING WHEEL DOLLAR

Your 1949 Buff Investment

How much money did you spend on buffs in 1949?

If you don't know you certainly can find out.

The **JACKSON AIRWAY Ventilated BUFF** *will save you from 25% to 50%.*

That's why the large majority of people use them.

If you are not using them--what are you waiting for?

WARNING NOTICE—Jackson Buff Corporation of Long Island City, N. Y. has rights under U. S. Patents Nos. [illegible] and D. 140,344 which have valued rights and also on its coined buff having been the subject of an infringement of the rights of the Buff. Owner intends to protect all rights and may infringement.

JACKSON BUFF
CORPORATION
29-03 FORTY-FIRST AVE., LONG ISLAND CITY 1, N. Y.

Personals

also his present office as Treasurer, succeeds **Aaron E. Carpenter,** who voluntarily relinquished the presidency and was elected Chairman of the Board of Directors.

Mr. MacDonald, who is forty-six, was graduated from Wharton School, University of Pennsylvania, in 1927 and entered the employ of E. F. Houghton & Company that year as a cost clerk. He has since served as industrial engineer, credit manager, and Treasurer (1942). He was also named assistant to the president in 1946.

One new director was elected, **Dr. James T. Eaton,** Manager of Research, who has been with the company since 1937. Dr. Eaton was formerly a research chemist for National Aniline Division, Allied Chemical & Dye Corporation. He received his Ph.D. degree from the University of Illinois in 1934. He has headed Houghton's Research Department since 1946. His chief interest has been in the development of surface-active agents.

Wilfred S. McKeon, President of Sulphur Products Company of Greensburg, Pa., was recently quietly married to Miss Alma Hensel. The private wedding ceremony was solemnized at the Most Holy Sacrament Rectory, Father O. L. Marcian, O.S.B. officiating.

The former Miss Hensel is principal of Rughton School in Greensburg. Mr. and Mrs. McKeon will make their home at 913 Highland Avenue, Greensburg, Pa.

G. S. Scott, Vice-President of Gerity-Michigan Corporation, Adrian, Mich., will be in charge of this company's new Prozite Division which will handle national sales of Prozite buffing and polishing compositions.

Scott

Thomas P. Gallagher is now Assistant Sales Manager of Munray Products, Inc. Formerly associated with the Atlas Engineering Company as a sales engineer, he will assist Ray W. Grace, Vice-President, in a sales-expansion program.

Mr. Gallagher is a graduate of Culver Military Academy and attended Brown University and Kenyon College, where he majored in biology and chemistry. After his discharge from the Air Corps, he worked in the development department of the Surface Combustion Corporation and later in the development and control laboratory of the Textileather Corporation before going with Atlas Engineering Company.

Obituaries

✤ **Richard H. "Dick" Alden,** for several years a sales representative with Frederic B. Stevens, Inc., of Detroit, died at Toledo, Ohio, on February 14, 1950 after a brief illness.

Mr. Alden represented Stevens principally in western Michigan where he had many friends in the plating and polishing industry. He was a very active member of the American Electroplaters' Society.

Mr. Alden is survived by his widow and three sons.

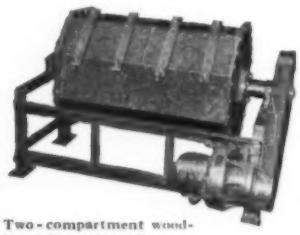
✤ **R. H. Ruenzel,** President of Ardco, Incorporated, Chicago, Ill., passed away on February 20. He had been associated with the plating and polishing industry for approximately thirty years in an executive capacity and had been President of Ardco since its inception approximately five years ago. Prior to that he had been associated with a buffing-compound manufacturing concern in the Middle West. He was a member of the American Electroplaters' Society.

✤ **William Frank Mershon** met a tragic and untimely end on December 24, when he was struck by a B. & O. express train while taking his usual Saturday morning walk. He was co-owner of the Bailer and Mershon Plating Company, Philadelphia, Pa., and a member of the Philadelphia Branch of the American Electroplaters' Society since 1944. Fifty-one years old at the time of his death, he is survived by his wife and daughter.

A TUMBLING BARREL FOR EVERY PURPOSE

Yes . . . Henderson can supply you with tumbling equipment in a variety of sizes, shapes and materials for practically every tumbling requirement. Nearly three quarters of a century in designing and manufacturing tumbling barrels for the GRINDING, BURNISHING, POLISHING and CLEANING of metal stampings, balls, bearing races, forgings, small castings, screw machine products, jewelry, wire forms and small metal parts. Tilting type barrels of Steel, Wood or Alloy Metal . . . Horizontal type barrels of Cast Iron or Cast Steel. Wood or rubber lined in all Models. Also special barrels for plastics.

#5A Motor Driven Tilting Oblique Tumbling Barrel.



Two-compartment wood-lined Burnishing Barrel.

If your requirements call for faster production and finer quality at lower cost or if you require Tumbling Barrels of special design, our Development and Engineering Service will be glad to make recommendations.

Write for further information.

Since 1880 - Designers and Builders of Tumbling Barrel Equipment

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Controlled Oxidation Pentrate

is Blacker

THE NEW CONTROLLED OXIDATION PENTRATE FOR RAPID, ECONOMICAL BLACK OXIDE FINISHING OF STEEL.

This new method and product is 25 to 50% faster acting and costs less.

The new C.O.* Pentrate is unique, trouble-free, and easy to operate.

Steel parts are finished a dense jet black in solutions that are under control at all times and operate at peak efficiency.

Controlled oxidation was designed to meet all black oxidizing requirements for single and double bath operations.

A BRAND-NEW PRODUCT!

Easy, Fast, Lower Costs

C.O.* [Pentrate is a development resulting from 25 years' experience in black oxide finishing.

Heatbath Corporation introduced black oxide finishing in 1925. Since then it has marketed more black oxide finishes than all others combined.

Write for Data Sheets describing the new Controlled Oxidation Pentrate.

HEATBATH CORPORATION

SPRINGFIELD 1, MASS.

In Canada: Wm. J. Michaud Co., Ltd., Montreal, Quebec

Fill in Coupon and mail today!

HEATBATH CORPORATION P-2
Springfield 1, Mass.

Please send me new data sheets on Controlled Oxidation Pentrate.

Name .....

Position .....

Firm .....

Address .....

* *Controlled Oxidation.*

A COMBINATION THAT IS HARD TO BEAT

Cowles

KW and SK

All subsequent cleaning operations are reduced to a minimum by using K W alkaline cleaner and S K emulsion type cleaner together in the pre-soak operation. These two fast acting, efficient and economical cleaners do a real job of removing oils and stubborn soil when used in combination.

K W Cleaner alone will handle all cleaning operations after the soak cleaning. It can be used in still tanks—with or without electric current—and in all standard washing machines.

COWLES TECHNICAL SERVICE ON REQUEST

PROMPT SHIPMENTS FROM LOCAL STOCKS

Cowles Chemical Company

METAL CLEANER DEPARTMENT • CLEVELAND 3, OHIO

A PERFECT TEAM!

FOR ZINC

ARE YOU GETTING *THESE RESULTS* FROM YOUR PRESENT BATHS?

FOR CADMIUM

ROHCO 100 BARREL ZINC BRIGHTENER:

ROHCO 100 is a concentrated liquid brightener easily diluted with water for daily or single load additions. Produces brilliant deposits directly from the bath at a lower cost. Has the ability to plate many types of ferrous metals which usually do not readily plate with zinc.

An improved zinc bath formulation minimizes brightener consumption, promotes rapid deposition without re-solution of the plated zinc, reduces chemical attack of zinc anodes and makes proper solution maintenance easier. Your present bath can readily be changed to the improved formulation.

Although ROHCO 100 Barrel Zinc Brightener can be used in your present bath, its combination with the improved zinc bath formulation is unequalled for highest production at lowest cost.

LOWEST COST

HIGHEST PRODUCTION

SIMPLEST CONTROL

ROHCO 20XL CADMIUM BARREL AND STILL BRIGHTENER:

ROHCO 20XL is a concentrated liquid which gives highest throwing and covering power at a cost of less than 2% of the cost of the cadmium metal plated. Produces brilliant deposits directly from the plating bath at the lowest cost per load.

ROHCO 20XL gives unbelievable uniformity of deposit thickness and hence reduces the amount of cadmium consumed in meeting minimum thickness specifications. An improved cadmium bath formulation provides unusually high conductivity and, with ROHCO 20XL, permits temperatures up to 105° F. in barrel plating.

ROHCO 20XL is very easy to control because it has an unusually wide latitude of operable concentration range.

Conversion to ROHCO 100 or ROHCO 20XL does not entail extra treatment or delay in production.

SEND SAMPLE OF YOUR PRESENT BATH FOR FREE ANALYSIS AND RECOMMENDATIONS!

ROHCO

ROHCO PRODUCTS

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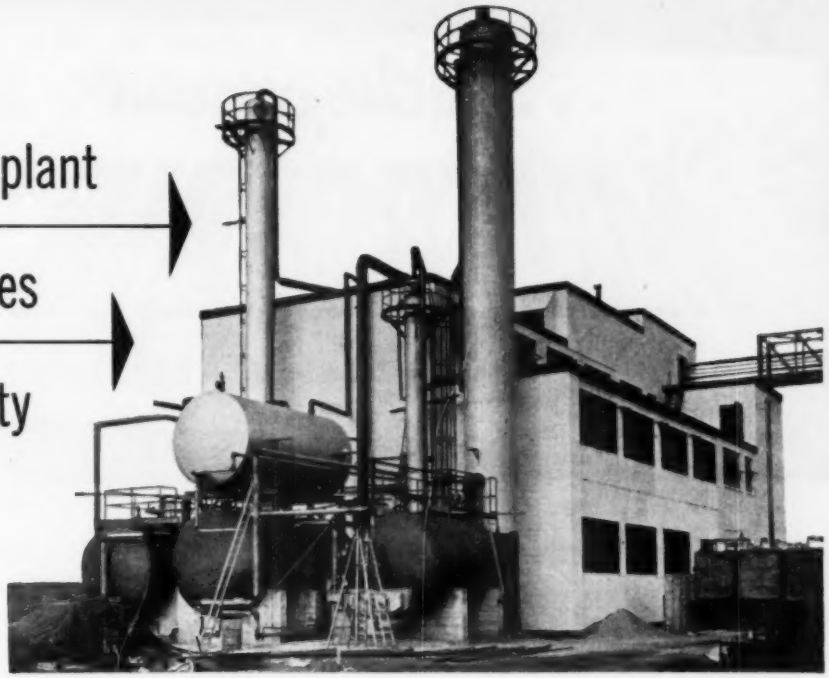

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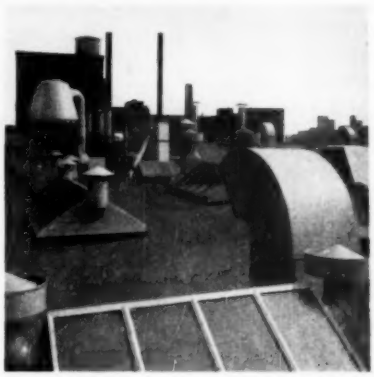

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A specially formulated primer . . . quick drying and flexible . . . which provides maximum adhesion on hard-to-stick-to metals such as brass, tin, lead, galvanized metal, zinc, steel, cadmium, magnesium, aluminum, or bronze. MICCROLOID Primer acts as a rust inhibitor . . . protects metal before painting . . . forms insoluble phosphates at the metal surface . . . prevents corrosion from creeping beneath the paint film . . . and provides a corrosion-resistant anchor coat.

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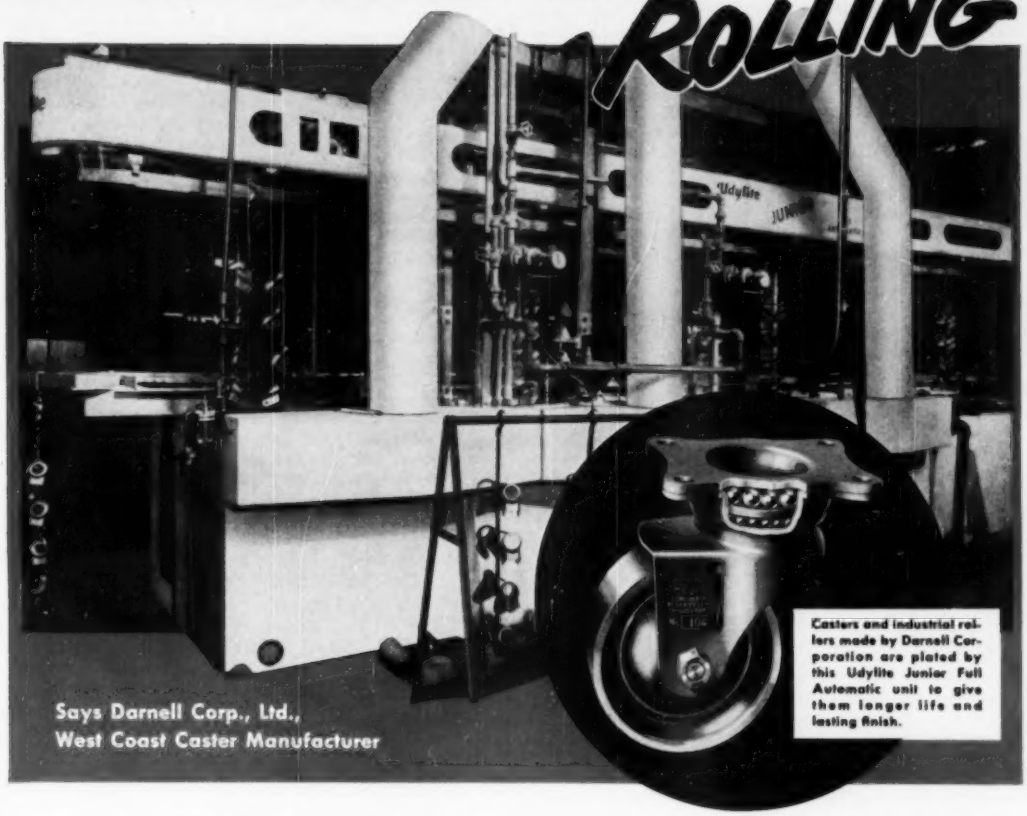

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West Coast Caster Manufacturer

Casters and industrial rollers made by Darnell Corporation are plated by this Udylite Junior Full Automatic unit to give them longer life and lasting finish.

A YEAR AGO the Darnell Corporation Ltd., Long Beach, California, faced a bottleneck in their plating department. Barrels of steel parts were stacked up, waiting to be plated. Since installing a Udylite Junior Full Automatic, they are able to keep up with production by operating the machine only part time. In addition, parts are now thoroughly cleaned, pickled and, after plating, given a dichromate dip to improve paint adhesion.

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Udylite offers a complete line of plating and metal finishing equipment for all plants. Trained engineers are available at all times for consultation with you concerning your plating problems. Call in your Udylite Technical Man today. No obligation.

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DETROIT 11, MICHIGAN

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Representatives in Principal Cities

Trade Literature

L—368. Corrosion Resisting Fans—A 12-page Bulletin 1103, issued by The Duriron Company, Inc., Dayton 1, Ohio, describes Durco Corrosion Resisting Fans. Made of parts cast in Duriron, Durichlor, or Durimet 20, they are said to handle practically any corrosive, such as fumes from pickling and plating tanks.

The fans are built in five sizes with capacities up to 7500 cfm. The three larger fans are now constructed with an impeller shaft supported in two bearing housings, a new construction which permits speed changes through sheave changes, easier servicing of motors, and use of motors with standard shafts. In some instances, motors of smaller horsepower can be used. For further information, use Reader Service Card.

L—369. Abrasive Belt Applications—A new "Step Up Production" booklet on the use of abrasive belts in industry is now available from Minnesota Mining & Manufacturing Company, 900 Fauquier Street, St. Paul 6, Minn. It provided 36 pages of case histories and technical data on grinding and polishing of carbon- and stainless-steel sheets, steel tubing and bars, plastics, ceramics, glass, wood, odd-shaped products, and castings of gray iron, manganese, bronze, and aluminum.

Also covered is the new "pre-finishing" technique, in which the usual process of steel-forming-and-then-polishing is reversed in order to achieve maximum production-line speed.

In addition the booklet provides details on belt equipment, belts, and contact wheels. For your copy, use Reader Service Card.

L—370. Plastic Tubing—U. S. Stoneware Company, P. O. Box 350, Akron 9, Ohio, offers an illustrated 24-page catalogue, "Tygon Flexible Plastic Tubing". It presents tables of physical properties and chemical resistance of six standard tubing formulations, and discusses their toxicity and temperature limitations, as well as methods of making connections and other similar questions. Each kind is available in 37 sizes, inside diameters from 0.12 to 1 inch and different wall thicknesses. A variety of applications is described. For your copy, use Reader Service Card.

L—371. Control Instruments—The Autumn, 1949 issue of "Modern Precision", house organ of Leeds & Northrup Company, 4902 Stenton Avenue, Philadelphia 44, Pa., contains several articles of interest to platers. They deal with *p*H electrodes and *p*H determinations, automatic control of fusion of tin coatings, polarigraphic analysis, and potentiometers in corrosion testing. For your copy, use Reader Service Card.

L—372. Barrel Finishing with Alundum Abrasives—A short article in which this subject is discussed appeared in the December, 1949 issue of "Grits and Grinds", house organ of the Norton Company, Worcester 6, Mass. For your copy, use Reader Service Card.

L—373. Vinyl Coatings—A new 4-page bulletin, "Gaco Vinyl Finishes and Coatings", is offered by Gates Engineering Company, P. O. Box 1711, Wilmington, Del. It describes a number of industrial-maintenance applications. For your copy, use Reader Service Card.

L—374. Liquid Flow Gauge—A completely redesigned Magna-Sight flow gauge is announced by the Fischer & Porter Company, 96 County Line Road, Hatboro, Pa., in its Catalogue 96. The unit consists of a short body, with flanged or screwed pipe connections, which accommodates a fixed orifice in the lower end. A tapered metering plug rises and falls with fluid flow rate in accordance with variable-area metering principles. The metering plug carries a permanent magnet, a hollow, cylindrical soft-iron follower rides in an external slot indicating flow rate on a scale.

The gauge is available in brass, bronze, iron, steel and type 316 stainless steel in sizes from 3/4 to 4 inch and with maximum capacities from 3.5 to 250 gallons per minute. Its accuracy averages about 5 per cent. Temperatures up to 400° F and pressures up to 500 psi can be accommodated. For your copy, use Reader Service Card.

L—375. Chemical Resistant Coatings—A 4-page folder is available from the Wilbur & Williams Company, Greenleaf and Leon Streets, Boston 15, Mass. It contains information on chemical, moisture and rust resistance of the coatings as applied to metal, concrete, and wood in varied industries. For your copy, use Reader Service Card.

L—376. Acid Proof Drain Line Items—Price List H-2, just issued by The Duriron Company, Inc., Dayton 1, Ohio, illustrates all Duriron drain line items—sinks, sink strainers, floor drains, traps, pipe and fittings—now available for handling corrosive wastes from chemical laboratories, plating rooms, etc.

The most notable design improvement is the use of cap-style cleanouts and C clamps. The new construction reduces to a minimum the area of metal that can be subjected to corrosive attack from trapped solutions. Since the solid rubber or similar gasket insures a complete seal, all cleanout parts can be made of regular materials and readily obtained or made at the job. For your copy, use Reader Service Card.

L—377. Chromium Chemicals—Diamond Alkali Company, Cleveland 14, Ohio, offers in its series "Chemicals You Live By" a new spiral-bound 32-page catalogue, "Diamond Chromium Chemicals, General Use and Applications". Among subjects of interest to platers are methods of manufacture of the chemicals; their applications for pickling and other metal treatments, plating and corrosion prevention; and methods of analysis of sodium bichromate. For your copy, use Reader Service Card.

L—378. Continuous Viscosity Control—The Brookfield Viscotrol, a new instrument unit which can be engineered into production systems to provide continuous and automatic viscosity control, is offered by the Brookfield Engineering Laboratories, Inc., Stoughton, Mass., through its Data Sheet 012.

The instrument, which can be supplied to control any viscosity from 2 to 50,000 centipoises within ± 1 per cent is of the rotary type and can be used to send signals or to operate valves, variable-speed drives, temperature controllers, or other correcting devices. For your copy, use Reader Service Card.

L—379. Resistant Floor Coating—Rock-Tred Corporation, 629 Washington Boulevard, Chicago 6, Ill., offers a 4-page bulletin of technical data and a 1-page sheet of application instructions dealing with Resn-X, a synthetic-polymer floor-coating material. Applied by trowel or brush, it air dries in 24 hours to provide a surface said to be highly resistant to practically all common acids and alkalies. The bulletin lists a variety of properties, including data on wear, hardness and loading tests, and results of chemical tests. For your copies, use Reader Service Card.

L—380. Humidity-Temperature Test Apparatus—Precisely controlled variations of humidity and temperature can be repeated periodically according to a predetermined program by means of a new apparatus recently announced by the American Instrument Company, Inc., Silver Springs, Md., in its Bulletin 2176. The standard apparatus provides three humidity-temperature program schedules of interest to government laboratories and manufacturers supplying equipment to the government, namely: (1) U. S. Signal Corps Standard Cycle No. Sc-D-16286-B (except for the sub-zero phase); (2) U. S. Navy Specifications JAN-M-745; (3) U. S. Signal Corps Standard Cycle No. ES-D-65103-A (except for the sub-zero phase). Apparatus for other program schedules is available. For your copy, use Reader Service Card.

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Patented bearing construction assures smooth running — No vibration even with capacity load.

Direct Drive — No belts. Gears fully enclosed.

Motor mounted on top, out of the way — Stays dry — Easily accessible.

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Spring-pressure ratchet lock, released by handy foot lever, holds barrel securely at any angle.

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Three standard sizes.

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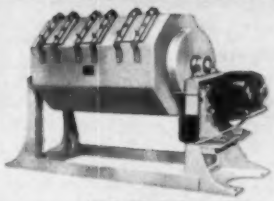
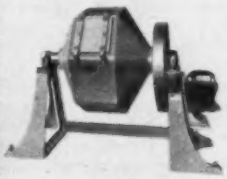
3 - compartment barrel can be used for three different deburring jobs at one time. This model is also available with 1, 2 or 4 compartments.





Triple-Action Deburring Barrel for very fast cutting. Specially shaped sides greatly increase tumbling action and reduce deburring time. Ideal for removing heavy burrs and smoothing extremely rough surfaces.

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Combination Steam-Heated Sawdust Barrel and Separator. The winning combination for maximum efficiency. Dries the work quickly, leaving it bright and spotless, and separates it from the sawdust without handling.

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Heavy, welded-steel frame and base affords absolute rigidity. Will not warp or twist when used on rough or uneven floors. There are no protruding feet or braces to interfere with the operator. Patented radial and thrust bearing construction assures that the balls always run in a perfect race regardless of the position of the barrel, providing smooth, long wearing operation.

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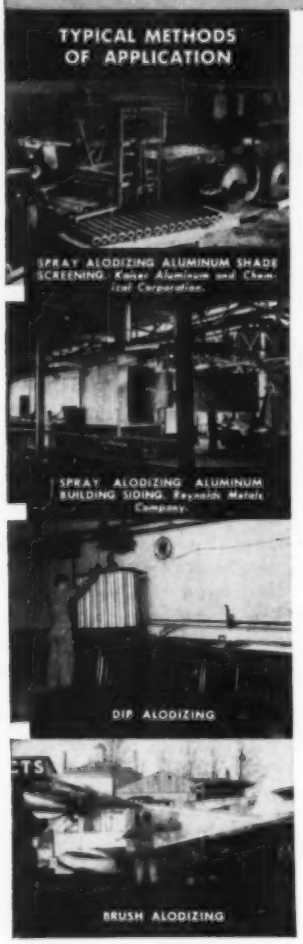
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EFFECTIVE. Alodized aluminum anchors the paint finish with a tough, durable bond; and greatly increases the metal's natural resistance to corrosion. "Alodine" qualifies under Specification AN-C-170 (Chemical Films for Aluminum and Aluminum Alloys).

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SPECIFY *"Alodine"* AND *Alodized aluminum* FOR PRODUCT AND FINISH DURABILITY.

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Trade Literature

L—381. Outdoor Exposure Tests—South Florida Test Service, Miami, Fla., in an 8-page folder describes its testing grounds and laboratory. For your copy, use Reader Service Card.

L—382. Electrostatic Precipitation—A 16-page, two-color bulletin on electrostatic precipitation, designated GEA-5212, has been announced by the General Electric Company, Schenectady 5, N. Y. Illustrated with photographs and diagrams, the publication explains how electrostatic precipitation works, gives case histories of seven typical installations where the system is being used, and describes the various methods of electrostatic precipitation and the electric equipment applicable to each method.

Recognized as the most efficient method known today for the control of small particles of matter, either liquid or solid, electrostatic precipitation is used for air cleaning, gas cleaning and recovery, painting, deposition and orientation of abrasives on belts and of flock, and separation. It can collect particles as small as 1/100,000 of an inch in diameter or deposit fibers as long as ¼ inch on an adhesive-coated cloth to make pile rugs. For your copy, use Reader Service Card.

L—383. Automatic Polishing and Buffing Machines—Hammond Machinery Builders, Inc., 1610 Douglas Avenue, Kalamazoo, Mich., announces release of an 8-page illustrated Catalog No. 50 describing the new Hammond Super Mold K-46-6 indexing Rotary Automatic Finishing Machines. Featuring what is claimed to be the world's fastest indexing, variable work-spindle speeds, and variable dwell time, the new Model K-Series machines have been designed to handle comparatively large work such as small frames for automobile-instrument panels, automotive accessories, builders' hardware, plumbing fixtures, electric appliances, household appliances, utensils, pots and pans, as well as for many different finishing operations on plastics. The catalog also describes the smaller J-Series indexing and continuous rotaries, straight-line automatics, and various types of abrasive-belt- and wheel-type heads, suitable for a widely diversified number of grinding, polishing, buffing, or deburring operations. For your copy, use Reader Service Card.

L—384. Chemically Resistant Pipe and Fume Ducts—A 4-page Bulletin 1J, "Permanite Pipe and Fume Ducts", issued by Maurice A. Knight Company, Kelly Avenue, Akron 9, Ohio, describes and illustrates items made of glass-fabric-reinforced furan-resin materials, including connections and fittings. Pipes are

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NEW PROZITE BASES contain unique emulsifying agents and have extremely high saponification values — Prozite Compositions set a new level of cleanability, eliminate cleaning difficulties, reduce reject losses due to failure of plating to adhere.

Prozite Compositions go farther, last longer, clean easier, produce brighter finish, cause less buff wear, cost less to use.

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Trade Literature

available in sizes 2¼-13-inch O.D., ducts in sizes 4¾-36¾-inch O.D. Physical properties and resistance to a variety of chemicals are given. For your copy, use Reader Service Card.

L-385. Corrosion Resistant Cement—Maurice A. Knight Company, Kelly Avenue, Akron 9, Ohio, offers a 4-page illustrated Bulletin No. 4J, "Permanite Resin Cement", which describes this material and its many uses in joints or for troweling to protect floor, tanks, and other chemical equipment. Application instructions include directions for surface preparation, mortar preparation, and setting time. Tables of physical and chemical properties are included. For your copy, use Reader Service Card.

L—386. Copper Blasting Shot—"Copper Shot for Blast Cleaning and Finishing Nonferrous Metal Parts" is the title of a 2-color 4-page Bulletin No. 69 issued by American Wheelabrator & Equipment Corporation, 555 S. Byrkit Street, Mishawaka, Ind. Advantages, operating results, and cost savings on several different applications are given in comparison with chilled-iron shot under identical conditions. For your copy, use Reader Service Card.

L—387. Polishing and Buffing Brushes—"Polishing and Buffing with Power Operated Brushes", is the name of a 16-page brochure L267 published by Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland 14, Ohio. The entire technique of brush finishing by manual and automatic equipment is described and illustrated, and cost comparisons are made. For your copy, use Reader Service Card.

L—388. Small Continuous Blast Cleaner—American Wheelabrator & Equipment Corporation, 555 S. Byrkit Street, Mishawaka, Ind., has issued a Bulletin No. 654, which gives complete engineering, application, and performance data on the new 15-inch continuous Wheelabrator "Tumblast" (airless blast cleaning and peening machine). Construction and design features are included in this 4-page, 2-color publication. For your copy, use Reader Service Card.

L—389. Lining for Wood and Steel Tanks—Installing adhering corrosion-resisting linings on old or new equipment is said to be as simple as plastering a wall or grouting a floor. Resin and catalyst-bearing carbon powder are mixed into a stiff putty and applied by trowel. Bare wood surfaces need only be dry; if wet, the surface can be dried with a blow torch. Good adhesion to clean steel is

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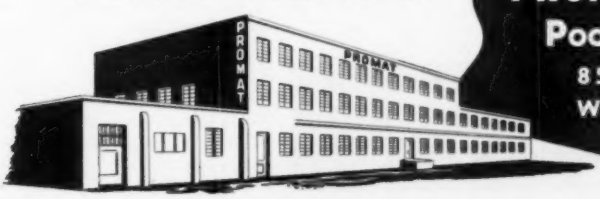

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Poor & Company
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Trade Literature

obtained by using a primer. The lining sets readily at room temperatures of 70° F and above. Coats on vertical surfaces can be made 1/16 inch without sagging, and any desired thickness can be built up with succeeding coats. On all metal surfaces, Fiberglas cloth is laid between two coats of lining material.

Material without the carbon filler can be applied in 1- to 3-mil coats by brush to give a highly glossy finish that is easy to clean. The glossy finish is applied over troweled coats where desired and can also be used by itself on bare new wood. Complete instructions for application are given in two new bulletins, C-6A and C-7, issued by the Carboline Company, 7603 Forsyth Boulevard, St. Louis 5, Mo. For your copies, use Reader Service Card.

L—390. Asphalt Mastic Flooring—The acid-resisting, waterproof, slip-proof and long-wearing qualities of Rulon Asphalt Mastic Floors for every industrial need are presented in an illustrated 8-page catalog issued by Ralph V. Rulon, Inc., 3900 N. 2nd Street, Philadelphia 40, Pa. Full information about details of construction as well as specifications are included for a variety of flooring material. For your copy, use Reader Service Card.

L—391. Aluminum Cleaner—A cleaner designed specifically for removing all types of soil from aluminum is discussed in a folder from The Diversey Corporation. This powdered alkaline material is identified as Diversey No. 36, and is reported to inhibit corrosion, provide instantaneous wetting action, and complete emulsification. For your copy, use Reader Service Card.

L—392. Acid Inhibitor—A 4-page bulletin on the function and use of Hibitite acid inhibitor is available from Monsanto Chemical Company, St. Louis 4, Mo. Said to be widely used in the pickling and cleaning of ferrous metals, it is claimed to be an excellent aid in producing clean, bright, high-quality products without excessive metal or acid losses.

The bulletin contains detailed instructions for inhibiting sulfuric, muriatic, and phosphoric acids for pickling of steels, removal of metal coatings, cleaning of equipment, and for the protection of iron and steel. For your copy, use Reader Service Card.

L—393. Dust Collectors—Rapid selection of correct size of unit-type dust collectors for any industrial dust problem requiring from 200 cfm to 3,600 cfm is given in 4-page illustrated Bulletin 610 issued by Aget-Detroit Company, Ann Arbor, Mich. Among tabulated comparisons are general recommendations of typical wheel sizes that any single unit will handle. Also given is a method for determining the correct amount of air suction required at any wheel in accordance with New York State Code requirements. For your copy, use Reader Service Card.

L—394. Grinders, Polishers, Buffers—The Hisey, Wolf Machine Company, Cincinnati 8, Ohio, Division of the Cincinnati Electrical Tool Company, offers a 36-page Catalogue 71 describing its many complete lines of bench and pedestal machines and accessories, including combination exhauster and filter. Motors used have much larger spindles and bearings than usual power motors, and motor controls have ample capacity and are approved by the Underwriters' Laboratories. For your copy, use Reader Service Card.

L—395. Racks from England—John Preston & Company Ltd., 56–64 Stanley Road, South Acton, London W3, England, offers two 4-page brochures, "The Electroplating Link Jig" and "Magnetic Plating Jigs" showing some of the 1500 rack designs furnished British plants. The former describes racks in which the parts are linked together by spring-loaded C-hooks, stirrup hooks, etc., while in the latter the parts are held by U-magnets on noncritical areas. Insulation used is said to withstand all plating and cleaning solutions, including solvent vapors. For your copies, use Reader Service Card.

L—396. Safe Handling of Radioactive Isotopes—Recommendations for the safe handling of artificially produced radioactive isotopes in the typical laboratory

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or small industrial operation are concisely set forth in a new handbook just issued by the National Bureau of Standards. It gives general safety recommendations which may be modified to suit the control requirements of different types of operations. Specific problems discussed are those of personnel, laboratory design and equipment, hazard instrumentation, hazard monitoring, and transportation of isotopes.

Handbook H-42, "Safe Handling of Radioactive Isotopes", 29 pages, 15 cents a copy, is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Remittances from foreign countries should be in United States exchange and should include an additional sum of one-third publication price to cover cost of mailing.

L—397. Safety Equipment—The 1950 issue of "Everything in Safety", a catalogue of personal protective equipment and industrial-safety devices, has just been released by the General Scientific Equipment Company, 2700 W. Huntingdon Street, Philadelphia 32, Pa.

This new catalogue covers respiratory devices, eye protection, hats, gloves, carboy pumps, drum pumps, and miscellaneous industrial-safety equipment. It is 46 pages, fully illustrated, and includes price list. For your copy, use Reader Service Card.

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L—398. Cadmium Brightener—A 7-page bulletin describing Rohco 20XL Cadmium Brightener Electroplating Process is available from R. O. Hull & Company, Inc., Dept. X2, 1279 W. 3rd Street, Cleveland 13, Ohio. According to the manufacturer, this brightener gives unusual uniformity of deposit thickness; exceptional brilliance of deposit over the widest current-density plating range; maximum production from barrel units; easy control through unusually wide concentration range; economical usage because the cost is many times less than the cadmium and labor is saved through improved throwing power, higher production and reduced rejects. For your copy, use Reader Service Card.

L—399. Centerless Polisher and Buffer—Production Machine Company, Greenfield, Mass., offers a 4-page illustrated bulletin featuring its Type S Centerless Polisher, quickly adjustable for either cylindrical (straight or tapered, up to 1½-inch diameter) or flat work. Special features include quick adjustment to horizontal position, to desired work diameter, and of feed speed; adjustable gauge for bevels; automatic take-up for belt stretch; quick tracking of belts. Besides flush-joint abrasive belts of various grits, endless felt belts are available for buffing. Specifications are given. This machine will be shown at the Tool Engineers' Exposition in Philadelphia on April 10–14. For your copy, use Reader Service Card.

L—400. Lead Covered Copper Coils—A 4-page illustrated bulletin issued by Knapp Mills, Inc., 121 Broad Street, New York 4, N. Y., describes homogeneous-lead-covered copper coils for heating and cooling sulfuric acid and other chemicals to which lead is resistant. It also furnishes information about heat-transfer calculations, physical and chemical properties, fabrication and maintenance. For your copy, use Reader Service Card.

L—401. Industrial Safety—Willson Products, Inc., Reading, Pa., has just issued a 64-page illustrated industrial-safety-equipment catalog which provides product information on the company's line of eye and respiratory equipment as well as technical and reference material to help the user select the proper equipment for the specific occupational hazard involved.

Among the subjects are (1) types of respiratory hazards, what respirators to use for specific hazards, and care and maintenance of respirators; (2) gas-mask selector tables showing gases and vapors prevalent in industry, with suggestions of gas-mask and canister assemblies for specific contaminants. For your copy, use Reader Service Card.

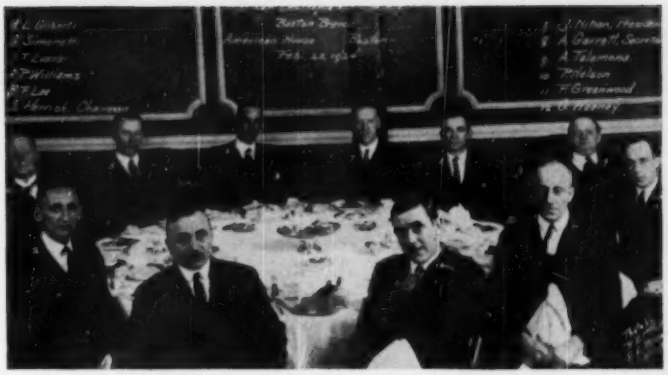
The Mailbox

Subject: Boston Convention

DEAR SIR:

Have just received the January issue of PLATING and note an article on page 85 regarding the 1950 Convention. How this brings back memories of years gone by. It is with the greatest of pleasure I read of the wonderful growth of my Boston Branch. I look back to the cooperation of my friend Frank Clark and the interest of the Charter Members of that Branch; how our old friend Francis Mackie took hold and did he work; then again Andrew Garrett and Louis Gale, those hard workers. All I could mention were tops and laid a solid foundation for the Branch. How I would like to be with them in June, but the years are telling. I have been retired for some years, but I still keep in contact as best I can with our San Francisco Branch, of which I am an honorary member.

I was happy to find that Francis Mackie is still with us and I wish him many years to come.



As I think of the old timers, I wonder how many of those that attended the meetings of the old National Association are still with us. I know that many are gone, and I have lost track of any who may still be among the living.

I have a picture of the old timers of the Boston Branch which I am sending you; it was taken in 1924.

The last Convention I was able to attend was in Providence, R. I. in 1923. What a time we had there. Now I am looking forward to 1951 and the Los Angeles Convention; health permitting I will be there with bells on to meet old friends. My reservations are in for 1951.

Thanks go to you for the work you are doing and best wishes to the Boston Branch for the coming Convention.

Sincerely yours,

SAMUEL HERRICK

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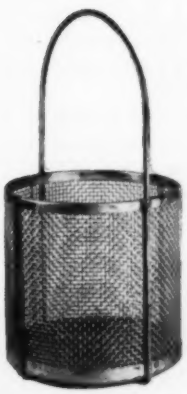

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APRIL 1950 VOL. 37 NO. 4

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Below: High velocity, double-slot hoods effectively pick up fumes as formed, remove sistant piping and exhausters.

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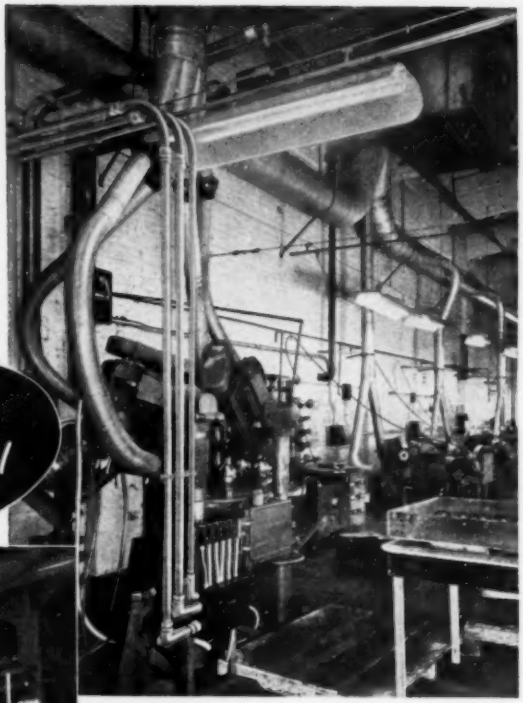

Plating Fume Removal

Above: Dust Collecting System, note flexible connections permitting movement of automatic buffing and polishing machine. Below: Two-pass monorail conveyor through direct fired gas oven.

Enamel Baking Conveyor Oven

Illustrating Kirk and Blum's wide experience and money-saving ingenuity are these installations in the plant of a large auto accessories manufacturer. Three separate systems eliminate fumes from pickling and plating tanks, control dust in polishing and buffing operations and provide accurately controlled heat for enamel baking in a conveyorized overhead oven. These are examples of the hundreds of systems designed, fabricated and installed by KIRK & BLUM. Turn your dust control, fume removal or low temperature oven problems over to experts with 40 years' experience.

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Editorial

The Plater's Microcosmos

ONE OF THE FASCINATING things about atomic physics is that classical laws do not apply. The very small world of the atom is governed by its own peculiar laws, many of which are not yet fully understood.

The plater also has his microcosmos, a world of fine pores and scratches. It too has its own laws, different from those which pertain to gross dimensions. Strong evidence is beginning to accumulate which indicates that the bath compositions and plating conditions which favor microthrow into fine crevices are the very ones which give the poorest macrothrow into large recesses.

These new findings have an important application in the field of levelling and reduction of overall finishing cost, which will be discussed at the American Electroplaters' Convention in June.

One also suspects that they may have an important bearing on the corrosion protection which a cathodic plate affords a defective base metal. If that is so, choice of plating bath and plating conditions will be governed by consideration of microthrow instead of macrothrow, and the lack of the latter will have to be offset by better racking and anoding.

Platers who are concerned with these problems, and who is not, cannot afford to miss the history-making meeting in Boston at which they will be discussed.

Gustaf Soderberg

SUMMARY

Following an article in the September, 1949 issue of this journal, which revealed an unexpected and commercially significant activity of hydrogen in copper electroplating processes on steel, the present article continues with a study of cadmium and zinc electroplating processes. Embrittlement through hydrogen absorption by the cathode is measured in terms of the bend angle sustained by plated wires before fracturing. Both mild steel and stainless steel are studied, and prominent electroplating processes are selected for testing.

The results provide a basis for predicting the scope of the hydrogen problem that a shop might encounter when it changes from one plating operation to another, as well as a quantitative measure of the hydrogen injury caused by each of the baths studied.

HYDROGEN EMBRITTLEMENT IN CADMIUM AND ZINC ELECTROPLATING*

C. A. ZAPFFE and M. E. HASLEM

Baltimore, Maryland

Introduction

Particularly during the recent War, when it became important to replace cadmium plating with zinc plating because of shortage of cadmium, some critical issues developed regarding the extent of the damage to steel which might be caused by hydrogen absorption.

With the exception of a German report by Fischer and Bärmann[1], very little had ever been done in the way of quantitatively measuring the effects of hydrogen absorption and comparing them among a group of electroplating processes. The importance of the problem had been emphasized in two papers by Zapffe and Faust[2,3], who demonstrated in a qualitative manner that hydrogen absorbed during electroplating is more far-reaching in its effects than commonly recognized.

Accordingly, the change from cadmium plating to zinc plating on hydrogen-sensitive steels, e. g., such as were used for machine-gun clips, presented a problem: there was no strict basis for prediction of the damage to be encountered.

In 1945, the present authors developed a quantitative measure of hydrogen embrittlement involving the bend values for wire[4]; and the wire-bending test was then applied to a number of representative electroplating processes. Chromium plating, a well recognized cause of hydrogen absorption, was first studied[5]. Next a series of copper plating processes was examined, the results having been reported recently in this journal[6].

During the work with chromium, a standard cadmium bath had been included for purposes of comparison, and it was striking to find that cadmium plating caused as much damage to the steel as cathodic pickling, which is straight hydrogen plating.

The present study has been extended to cover not only several prominent cadmium baths in order to provide a better basis for judging the effects of cadmium plating but also a number of well known zinc plating solutions. Comparison can therefore be made both between the two kinds of plating and between individual processes within each kind. No attempt has been made to provide an exhaustive survey of the many individual processes; instead, a representative few have been selected, principally with the text "Modern Electroplating"[7] as a general guide.

Experimental Procedure

Specimens

In all tests here reported, duplicate runs were made

*From research conducted in the laboratory of the senior author in conjunction with a project on gas-metal systems sponsored by the Office of Naval Research.

on mild steel and on stainless steel. Reference is made to Table I in the preceding article[6] for a detailed analysis of the materials. The mild steel, SAE 1020, contained 0.18 per cent carbon and had been cold-drawn to 170,000-psi tensile strength. The stainless steel, AISI 440-C, contained 1.01 per cent carbon and 16.8 per cent chromium and had been cold-drawn to a 24.5 per cent reduction in area (133,000-psi tensile). Both steels were in the form of 1/16-inch wire which could be bent 180 degrees in the unplated conditions; and the reaction of both steels to hydrogenizing conditions had been so well explored in studies of immersion and cathodic pickling[8,9] that they can now serve as standards of reference.

Bend Test

For the details of this test, reference must be made to the previous papers[4,5,6]. Essentially a single-bend operation conducted at a constant rate around a fixed pin, the test provides an angle of failure which varies with treatment of the wire and provides a measure of the hydrogen embrittlement.

Plating Processes

These will be described in the course of the discussions of the separate baths. All plating was performed on a laboratory scale in 600-ml beakers, but according to recommended commercial procedures. The cathodes were duplicate 4-inch lengths of the wire just described. They were carefully cleaned by hand with emery paper, since pickling might obscure the hydrogenizing effects of the plating bath. The anodes were Type 302 stainless steel in those baths where soluble anodes were not employed. Agitation, where used, was provided by a small laboratory stirrer.

At the conclusion of plating, the specimens were immediately rinsed and immersed in ice water at 32° F (0° C) to inhibit diffusion and aging phenomena. One of the duplicate specimens was tested within 30 seconds, the other within 90 seconds.

Method of Plotting Results

The mild steel is represented on all graphs by black discs, the stainless steel by circles. Smaller black dots are occasionally used to indicate additional sets of tests, and they are always annotated.

On all graphs the full bend is the horizontal top boundary at 180 degrees. As stated, both steels display 180 degree bends in the unplated conditions and, therefore, are represented by superimposed circles at the upper left corner. The progress of bend angle toward the right with increasing plating time then reveals the effect of hydrogen absorbed during the plating process. Shaded areas on the graphs aid in visualizing the extent of the damage, so that the processes may be readily evaluated and compared one with another by comparing the sizes and positions of these areas.

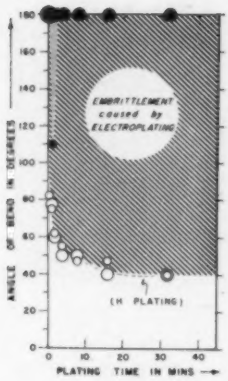

Fig. 1. Hydrogen embrittlement caused by electroplating with the Udylite Bright Cadmium process. The dashed line indicates the embrittlement caused by straight hydrogen plating (cathodic pickling) of this stainless steel

One will note that the black discs for mild steel lie along the line of full bends in most tests. They are included because they represent a metal of great commercial importance and of minimum sensitivity*. Type 440-C stainless steel, on the other hand, is one of the most sensitive of all steels to hydrogenizing and hence is most valuable in providing indications of embrittlement. One can more or less interpolate other grades of steel, plain and alloy alike, by placing them between these two indicators, the stainless steel perhaps simulating other highly hardenable steels. However, an extensive research remains to be conducted before the actual behaviors of other steels can be known, and a marked distinction has already been pointed out between AISI 440-C and SAE 1090[9].

Results with Cadmium Plating

Soderberg and Westbrook[7], in their broad review of cadmium plating, point out that acid baths have practically no commercial application. The principal differences among the numerous modern cyanide-bath compositions are to be found in the brightening agents.

Three commercial baths, all of the cyanide type, have been chosen for exploration here. They show a rather consistent behavior. All are strongly hydrogenizing, which is apparently a general characteristic of the cyanide bath. Any extension of the present study will therefore principally involve the effects of addition agents upon the strongly hydrogenizing tendency of the cyanide electrolyte. The discovery of an addition agent which would defeat the hydrogenizing action of the cyanide bath would be an attainment of great importance.

*It must be remembered that a bend of 180 degrees only expresses the limit of this particular test for discerning embrittlement and does not denote a complete absence of embrittlement.

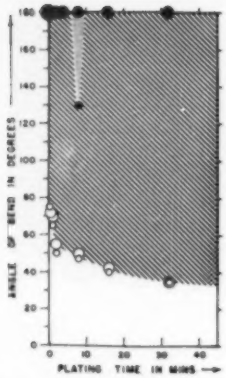

Fig. 2. Hydrogen embrittlement caused by electroplating with the Promat Cadmium process

Udylite Bright Cadmium

Test Conditions:

Electrolyte	23 g/l CdO
	96 g/l NaCN
	3 g/l Udybrite
Current density	2.15 amp/dm² (20 asf)
Temperature	30° C (86° F)
Anode	stainless steel

In Fig. 1, an immediate damage of both steels is evident for short plating periods. However, the mild steel reveals this with only one fracture, the ductility remaining unaffected for long plating times so far as can be determined by this test.

In sharp contrast to the mild steel, the stainless steel exhibits rapidly increasing damage, reaching very low values of bend for long plating periods. The surprising degree of injury which is caused by the hydrogen absorbed during plating in this bath will be recognized by comparing the position of the bottom boundary of the shaded area with that of the broken line for cathodic pickling—"hydrogen plating"—which is included on the graph. It should be noted that the cathodic pickling was conducted at a higher temperature (50° C; 122° F). Hydrogen plating brittleness at the temperature of the cadmium bath would lie above the cadmium plating values, since increasing temperature increases hydrogenizing[4].

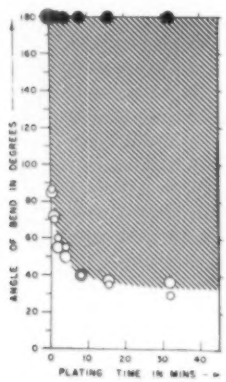

Fig. 3. Hydrogen embrittlement caused by electroplating with the duPont Cadalyte process

This situation warrants special attention from a commercial standpoint. No one even remotely familiar with hydrogen-caused defects would extensively hydrogen plate (cathodically pickle) a hydrogen-sensitive steel before sending it into service, nor would he advisedly so treat a steel later to be plated. Yet the data show that plating the steel for ten minutes or more with cadmium is the equivalent, so far as hydrogen pickup is concerned, to a half-hour cathodic pickle. Consequently, brittleness and all related defects must be seriously considered where sensitive metals are cadmium plated. Blistering of the plate itself must clearly remain a threat until the time when such hydrogenizing can be eliminated.

Promat Cadmium

Test Conditions:

Electrolyte	30 g/l CdO
	91 g/l NaCN
	21.2 ml/l C-28-S
	9.5 ml/l C-50-S
Current density	4 amp/dm² (37 asf)
Temperature	30° C (86° F)
Anode	stainless steel
Solution agitation	

As shown in Fig. 2, the behavior of this bath is almost the same as that of the preceding one, the bend angles lying insignificantly higher. No point can be made of the fact that the mild steel failed after eight minutes' plating time instead of two minutes', because the single instance of fracture is inconclusive.

duPont Cadalyte

Test Conditions:

Electrolyte	32 g/l CdO
	109 g/l NaCN
	19.8 g/l NaOH
	1.5 g/l Cadalyte Brightener
Current density	4 amp/dm² (37 asf)
Temperature	30° C (86° F)
Anode	stainless steel

Although cadmium anodes are advised for commercial operation of this bath, insoluble anodes were used in the present experiment in view of the limited amount of plating required. Fig. 3 shows results which are virtually identical with the two preceding sets of data, although no embrittlement is indicated for the mild steel. The embrittlement of this steel in the two pre-

ceding figures is probably too slight to afford a significant contrast.

One concludes from the three sets of data that commercial cadmium plating on stainless steel is at least as severe in its hydrogenizing propensities as straight hydrogen plating (cathodic pickling). The mild steel, on the other hand, is subject to little or no damage, although cathodic pickling embrittles this material about as badly as it does the stainless steel[5]. The remarkable distinction between the hydrogenizing behaviors of mild steel and stainless steel has been repeatedly observed[4] and is certainly most puzzling.

Results with Zinc Plating

In zinc plating, the acid bath is important along with the cyanide bath; consequently, both types were studied. Once again it was necessary to select a limited number of processes from among the many on the market, but certain principal issues are probably indicated by those chosen.

Acid Zinc

Test Conditions:

Electrolyte	240 g/l $ZnSO_4 7H_2O$ 20 g/l NH_4Cl 25 g/l $Al_2(SO_4)_3$· $18H_2O$*
Current density	4 amp/dm² (37 asf)
Temperature	30° C (86° F)
Anode	cp zinc stick

*Alternate bath addition

Two baths, one of which contained aluminum sulfate, were studied.

Fig. 4 shows that the bend values for acid-zinc plating all lie far above those previously shown for cadmium plating and above those to be discussed shortly for cyanide-zinc baths. The figure also indicates a slight improvement for the bath to which alum was added, although the distinction is not decisive. The shaded area is therefore arbitrarily placed within the whole point group and toward the data for the alum-free bath. The rather wide scatter of the points within each set is characteristic of the bend values in the high range, for the fracture angle here changes much more rapidly with a given factor than it does in lower ranges.

Referring to the preceding report[6], one will observe that the embrittlement produced by acid-zinc plating is almost identical with that from acid-copper.

No bubbles, incidentally, were ever observed on either the mild steel or the stainless steel during plating in the alum-free bath. These tests therefore verify the phenomenon reported earlier[4] that important hydrogenizing can proceed in the absence of visible hydrogen evolution. Since the bubbles represent a secondary stage in hydrogen deposition, there can be a minimum rate of hydrogen deposition below which the gas enters the metal without leaving an excess for evolution. Some slight gas evolution was observed on

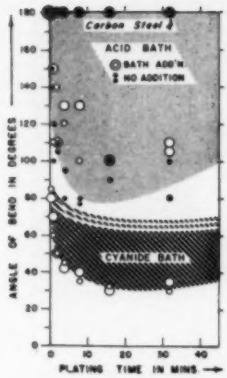

Fig. 4. Comparison of a standard acid-zinc bath with a standard cyanide-zinc bath on the basis of hydrogen embrittlement. Two series of tests are shown for the acid bath—with and without an alum addition

the cathode during plating in the bath containing alum, whereas the bend data indicate lesser embrittlement. This, too, conforms with the results of other studies which show that hydrogen absorption by steel is a matter of subtle surface chemistry not necessarily related directly to external observations. Hydrogenizing of the metal cannot be judged by the fact of visible gassing.

Cyanide Zinc

Test Conditions:

Electrolyte	52 g/l ZnO 93 g/l NaCN 20 g/l NaOH
Current density	4 amp/dm² (37 asf)
Temperature	50° C (122° F)
Anode	cp zinc stick

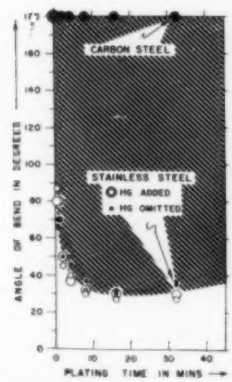

Fig. 5. Hydrogen embrittlement caused by electroplating with a mercury-zinc bath, with and without the mercury addition

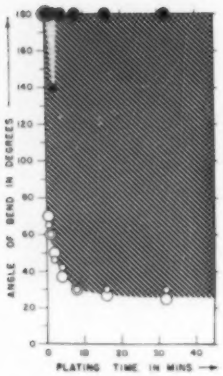

Fig. 6. Hydrogen embrittlement caused by electroplating with the Promat No. 99 zinc process

A conventional cyanide-zinc bath of this composition without addition agents yielded the lower curve for stainless steel in Fig. 4, where the results are combined with those just discussed for acid baths. Mild steel remained uninjured.

These values prove the cyanide-zinc bath extremely damaging to the stainless steel, the curve lying even somewhat below the cyanide-cadmium values. The higher temperature (50° *vs.* 30° C; 122° *vs.* 86° F) of the zinc bath may, of course, account for this.

Attention should be called to the fact that in all these charts the stainless steel shows a loss of its 180-degree bend within the first minute of plating and often within the first 30 seconds where such tests have been conducted. This is a remarkable reactivity and indicates the excellent sensitivity of these specimens for studies of hydrogen absorption.

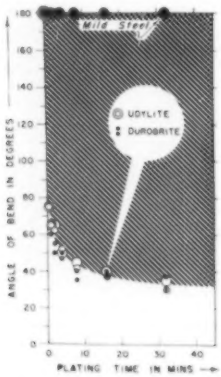

Fig. 7. Hydrogen embrittlement caused by electroplating with the Udylite Bright Zinc and the Durobrite Zinc processes

Mercury Zinc

Test Conditions:

Electrolyte	26 g/l ZnO 54 g/l NaCN 4.2 g/l NaOH 0.25 g/l $HgSO_4$*
Current density	4 amp/dm² (37 asf)
Temperature	50° C (122° F)
Anode	cp zinc stick

*Alternate bath addition

Although essentially a cyanide bath, the mercury-zinc electrolyte contains considerably different proportions of constituents than the preceding bath and has mercuric sulfate added as a brightener.

In Fig. 5, the results of two series of tests, one with and one without the mercury addition, show uniformly low bend values. These are strictly comparable with those for the preceding zinc cyanide bath and conform to the generally severe effects of all cyanide baths yet investigated. The mercury was especially studied because that element has been claimed by some investigators to increase hydrogenizing when present in an electrolyte or an acid pickling solution[10,11]. No significant effect is shown here.

Promat No. 99 Zinc

Test Conditions:

Electrolyte	52.4 g/l ZnO 114 g/l NaCN 93.4 g/l NaOH 21.0 ml/l Promat C-42
Current density	4 amp/dm² (37 asf)
Temperature	30° C (86° F)
Anode	cp zinc stick

The data in Fig. 6 for this commercial cyanide bath containing a brightener show the customary severe embrittlement of the stainless steel. In fact, these bend values are possibly the lowest of all reported here. Once again, a single fracture occurs in the series of mild steel specimens.

A short series of tests was also conducted using additions of the proprietary "Doctor Solution" to determine if the bend values were changed by this reagent. The plating time was fixed at eight minutes, and all other factors were held as listed above. The results shown in Table I indicate no significant effect.

Udylite Bright Zinc

Test Conditions:

Electrolyte	42 g/l ZnO 68 g/l NaCN 33 g/l NaOH 0.825 g/l Brightener
Current density	4 amp/dm² (37 asf)
Temperature	30° C (86° F)
Anode	cp zinc stick

TABLE I. EFFECT OF DOCTOR SOLUTION ON BEND ANGLE

Drops per liter	Angle of Bend	
	SAE 1020	AISI 440-C
1½	180, 180	35, 32
3	180, 180	32, 32
6	180, 180	32, 30

Fig. 7 shows the customary severe embrittlement of the stainless steel, with none indicated for the mild steel.

Durobrite Zinc

Test Conditions:

Electrolyte	66.6 g/l ZnO
	92.5 g/l NaCN
	65.8 g/l NaOH
	0.5 g/l Na_2S
	0.935 g/l RH309
	0.25 g/l RH774
Current density	4 amp/dm² (37 asf)
Temperature	30° C (86° F)
Anode	cp zinc stick

The data for the tests with this commercial formula are also plotted in Fig. 7 where the points almost exactly coincide with those of all foregoing cyanide baths.

Since these formulas have included a rather wide range of proportions of the common ingredients and several widely differing proprietary reagents have been added, it is quite remarkable that the hydrogen behavior is so uniform. Only when the bath type is changed from the cyanide do the results change appreciably.

Of course, a more thorough exploration of existing electrolyte compositions might disclose some which largely protect the cathode against hydrogen embrittlement. The present study, however, suggests that the hydrogen problem will not be readily solved. The cyanide bath seems to have an overwhelming hydrogenizing tendency, at least for the Type 440-C steel.

Certainly it would be a valuable project to pursue these preliminary results in an attempt to find an addition agent which would suppress the hydrogenizing tendency of the cyanide bath.

Conclusions

On the basis of this study of hydrogen absorption during cadmium and zinc electroplating as it affects the bendability of a steel cathode, certain conclusions can be tentatively drawn:

Type of Steel

1. Mild steel, at least cold-drawn SAE 1020, is much less embrittled by any of these plating processes than it is by cathodic pickling, or straight hydrogen plating. These results are consistent with the known current efficiencies, or comparative hydrogen transfers to the cathode.

2. Stainless steel of the AISI 440-C type is severely embrittled by all plating processes here investigated to the extent of exceeding in certain cases the damage caused by straight hydrogen plating. Such results are contrary to predictions based on known current efficiencies and constitute an unsolved problem.

Plating Solutions

On the basis of results with Type 440-C steel as a sensitive indicator of hydrogen absorption, it is found that:

1. Cyanide solutions for both cadmium and zinc plating uniformly exhibit a powerful hydrogenizing effect which seems affected neither by normal variations in composition nor by numerous reagents added to the bath as brighteners.

2. Acid-zinc solutions are much less severely hydrogenizing, confirming a similar comparison drawn in earlier work with copper plating.

Acknowledgment

The authors thank the Office of Naval Research for its partial sponsorship of this work, also the several representatives of commercial products here studied who contributed samples and specific information about their products.

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leaders in the industry xxiii

G. W. Jernstedt

GEORGE W. JERNSTEDT while one of the youngest men in this series, can already look back on several important contributions to the plating industry.

Born on December 23, 1915 in Jersey City, N. J., he spent his early life in Bloomfield, N. J., where he received his preliminary schooling. He worked his way through Newark College of Engineering in nearby Newark, N. J. and obtained his B.S. degree in 1937.

A year earlier Mr. Jernstedt had begun work for Westinghouse Electric Corporation on an industry co-operative plan, and on graduation he remained with this company as Materials and Processes Engineer. However, he continued his studies, taking graduate work at the Polytechnic Institute of Brooklyn until 1941. This was interrupted for one year, which he spent at Michigan State College on a Westinghouse Lamme Scholarship given to him as the company's outstanding young engineer. His studies at Michigan State and thesis on electrodeposition of beryllium oxide led to his M.S. degree.

In 1943 he was made Liason Engineer on finishing and corrosion problems, working out of East Pittsburgh. As such he assisted in setting up Naval Ordnance plants for chromium plating of gun barrels and other plating operations. In 1946 he was made Manager of Electroplating Projects.

Mr. Jernstedt also does some consulting work in the electrochemical and medical fields and, through his Chem-Medical Company, has developed medical equipment and processes now being investigated in a leading medical school and hospital.

Among Mr. Jernstedt's earlier developments are a predip for use in the phosphating of such metals as zinc, cadmium, and aluminum; a bright ternary-alloy plating process marketed under the trademark Albaloy; and a bright dip for aluminum, copper alloys, Kovar, and similar metals. All of them have found commercial application, as has his Electroplating Computer.

Mr. Jernstedt, however, is probably best known for his development of plating with periodically reversed current, so-called PR plating, and organic-free baths for use with such plating, for example the WES-X cyanide copper solution. These high-speed processes and baths have opened up new avenues for reduction of polishing prior to decorative plating and produce deposits of superior physical properties.

Mr. Jernstedt is a member of the American Chemical Society and The Electrochemical Society. In the American Society for Testing Materials, he is chairman of a section on Luster Tests of Committee B-8. In the American Electroplaters' Society he serves as chairman of Research Project Committee No. 7 and as a member of its Editorial Board. He has presented numerous papers at its conventions and branch meetings.

Mr. Jernstedt belongs to Sigma Xi, honorary scientific society, and is listed in Who's Who in the East.

With all his activities Mr. Jernstedt still has some time for hobbies. One which is particularly popular with his wife consists of installing electrical improvements, including a precipitron, in his home in Forest Hills near Pittsburgh. Another is collection of unused U. S. stamps in blocks and sheets, still another photography. He entered scouting twenty-two years ago and advanced to scoutmaster. Having three children to bring up, he is now chairman of the local cub-scout committee.

ADHERENT ELECTRODEPOSITS OF NICKEL ON THIN FILMS OF HIGH CHROMIUM ALLOYS*

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ABSTRACT

It is possible to obtain adherent electrodeposits of nickel in layers up to 0.003 inch (75 μ) thick on thin films of high-chromium alloys by (1) boiling the object coated with the thin film in distilled water; (2) etching for ten minutes in a solution of 3 parts water, 2 parts hydrochloric acid and 1 part nitric acid; (3) transferring wet to a plating solution consisting of 1 gallon (liter) of distilled water, 10.7 oz (80 g) nickel ammonium sulfate, 2.1 oz (16 g) ammonium chloride, and 2.1 oz (16 g) boric acid at *p*H 1.5 and plating at a current density of 15 asf (1.6 amp/dm^2) for one minute; and (4) transferring to a solution similar to the above but at *p*H 4.5 and plating at a current density of 7 asf (0.75 amp/dm^2).

INTRODUCTION

In certain applications it is very desirable to have an unusually adherent metal film evaporated onto a glass or quartz surface. One such film consists of a chromium alloy (90 per cent Cr) approximately 0.0001 inch thick upon which it is sometimes desirable to electrodeposit nickel. The combined coating is useful on piezoelectric quartz plates, for example, to provide suitable mechanical coupling to various sound-transmitting media.

The building up of this metal film by the electrodeposition of nickel presents several unusual problems, many of which have been attacked by electroplaters[1–12]. However, the practice of etching out the chromium which is sometimes employed in the preparation for plating of stainless steels with their, perhaps, 14–18 per cent Cr cannot be used in case of the desirable thin alloy films with their very high chromium content. Instead the structure of these films makes adhesion more difficult to achieve, and, in addition, causes their electrical resistance to be very high. In a typical case the resistance across the diagonal of a one-inch square film of alloy is approximately 50 ohms. It can be seen that even at low current densities this places one portion of the surface at a large potential difference with respect to another. These differences show up immediately when the plating is started, a current of 0.25 amperes being sufficient to concentrate most of the deposit from the solution near the point of electrical contact and "burn" a hole in the film within a few seconds. This is precisely what happens when an attempt is made to use the Gardam method[11], for example.

Reuss[23] suggests depositing nickel on high-chromium alloys from a solution having a *p*H less than 2.5. This *p*H, however, is only suitable for deposition of very thin coatings. Other methods given in the literature include preliminary etching or plating in a low-*p*H bath followed by final plating in a less acid bath.

Most of these methods are based upon work done upon alloys containing less than 20 per cent chromium, and all are ineffective in producing the desired nickel coating, on account of either excessive current-density requirements or poor adhesion. A combination of preliminary etching, plating in a low *p*H-bath, and final plating in a more alkaline bath has been found in this laboratory to be the most desirable method for use with the high-chromium-alloy film. The *p*H values, current density, solution composition, cleaning and handling methods are all critical for good result.

A further difficulty to be overcome is the curling of the nickel deposits at the edge of surfaces coated by the alloy film. Since the current density is generally higher at the edges than at most other places on the surface, nickel begins to deposit here more quickly. Further deposition thereon follows very rapidly due to the large cumulative reduction of the resistance from the connecting wire to the points of deposit, and the internal stresses in the deposit start the curling process. It takes but a small amount of

*This article, while dealing with a specific problem of limited importance, points the way to solution of more general problems in the plating of high-chromium alloys.—Editor.

uneven nickel deposit near the edge to set up the internal-stress unbalance necessary to start the curling, which lifts the film and even very thin layers of the substance beneath it.

A method is described below which gives a suitable nickel coating for high-chromium-alloy films evaporated onto small glass or quartz plates.

Description of Method

The small articles upon which the film has been evaporated are first placed in vigorously boiling distilled water. After five minutes *most* of the water is removed, but care is taken that water covers the metal film at all times. To the water is added a mixture[18] of 2 parts of concentrated hydrochloric acid and 1 part of concentrated nitric acid, such that the water in the container amounts to 3 parts of the total. The part should remain in this etching bath for ten minutes. At the end of that time the etching solution is rinsed away by flooding with boiling distilled water, keeping the film continuously covered with water. The article in its container with covering liquid is then transferred to and bodily immersed in the plating bath. The nickel plating solution consists of the following materials in 1 gallon (liter) of distilled water: 10.7 oz (80 g) nickel ammonium sulfate, 2.1 oz (16 g) ammonium chloride and 2.1 oz (16 g) boric acid, brought to a *p*H of 1.5 by the addition of a suitable amount of hydrochloric acid. Electrical connection with the film on the article should be made below the surface of either the rinse water or the plating bath, and no more than 10 seconds should elapse between the end of the flooding operation and the beginning of plating. The current density should be 15 asf (1.6 amp/dm^2) and the time of plating one minute. Current flow is confined to the alloy film by using a connecting wire completely coated with rubber except for the point tip. The article is then quickly removed and transferred to a second plating solution made as above but without the addition of hydrochloric acid. Such a solution will have a *p*H in the vicinity of 4.5 and should be operated at a current density of 7 asf (0.75 amp/dm^2). This will give a good coating up to a thickness of at least 0.003 inch (75 μ).

Discussion

The foregoing procedure may appear to be somewhat complicated; however, it has been found that omission of any step leads to poor adhesion and, generally, to inclusions in the deposit. A consideration of each phase of the procedure is helpful.

The boiling water in the first phase is desirable for three reasons: (1) it seems to aid the cleaning and speed the etching process; (2) it provides a more even initial distribution of the etching solution; and (3) it provides a medium with which to protect the cleaned and etched film from the air.

The second phase is equally important in that the transfer of the plate to a position beneath the surface of the plating bath is accomplished without having to take the chromium-alloy film through the surface of the plating bath. This is particularly important since multiple filtrations and rigorous cleanliness do not seem to eliminate foreign matter from the surface of the bath; and any time the chromium-alloy film goes through this surface, much of the foreign matter adheres to it. The presence of the foreign matter is indicated not only by numerous microscopic pits and spotty appearance but also by a general lack of adhesion. Plating in this bath is continued for a short time since it is only suitable for very thin layers. It is possible to use it to deposit (without curling) slightly thicker layers; however, the thicker deposit will cause the subsequent deposit to curl or peel where no curling or peeling would occur if the same final thickness had been deposited over the thinner preliminary coating.

The nickel ammonium sulfate bath was chosen because of its low deposition rate. It is particularly suitable for the deposition of the hard thin deposits which are especially desirable when the chromium film is being used on piezoelectric quartz plates.

Final transfer of the plate from the low-*p*H to the higher-*p*H solution can be made without a water covering and without causing the deposit to become laminated. It should, however, be carried out quickly and the plating current started immediately. For the higher-*p*H solution the nickel ammonium sulfate bath was chosen again because of its low deposition rate and in addition because of the fairly low tensile stress in the nickel deposited from the unacidified plating solution. Numerous baths are suggested in the literature, and some of these may be more desirable in specific cases where requirements are less exacting, or quite different.

Adhesion of the Deposit

Adhesion was determined in a qualitative way by attempting to scrape off the nickel coating. In some cases of good adhesion the alloy was fractured within itself, the rupture of the alloy film being readily observed under the microscope. In other cases the nickel and the alloy came off the glass or quartz together. In yet other cases the alloy was so adherent to the glass that the metal together with several layers of glass was broken off by the scraping.

Conclusion

The foregoing method is applicable for electrodepositing nickel on thin films of high-chromium alloys having a chromium content of approximately 90 per cent. The resulting nickel film is hard, lustrous, and seems to reproduce the finish of the basis metal, which usually has a high polish. It may be reasonable to assume that this plate could readily be obtained on alloys containing less than 90 per cent chromium by the same methods.

It appears possible to activate thin films of 100 per

(*Continued on page 383*)

Some Modern Methods of Surface Preparation Before Plating

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In this article are described three comparatively new methods of surface preparation, which may or may not be followed by buffing prior to plating, depending upon the end use of the product. These methods all make use of coated abrasives and produce finishes in the range of 25 microinches or less.

Mechanical Belt Polishing of Flat Surfaces

Mechanical flat polishing with belts prior to forming is related to the older art of polishing stainless-steel sheet. This relationship is chiefly in the similarity of the machines employed, the stainless-sheet polishers having been modified for the higher production necessary of such parts as bumper bars and automotive trim.

The procedure presently used is a continuous one. The flat stock is put through a series of flat-belt polishing machines called "heads" by the trade. The first few of these are roughing heads and use 60-, 80- or 100-grit aluminum oxide-coated belts, depending on the surface condition of the stock. These are followed by a series of intermediate heads employing successively finer grit sizes and lead up to the finishing machines which produce the final finish suitable for plating. The latter employ 220- or 240-grit aluminum oxide-coated greased belts and give a finish of 25 microinches or less.

The stock is inspected while on the conveyor which takes it to the degreasing machine. After the grease from the polishing heads has been removed, the sheets are coated with a resinous coat or a "dry draw coat" that protects the polished surface during the subsequent forming operation. These coatings may be applied either by dipping or rolling. In the forming of the part, needless to say, the forming dies must be in excellent condition. Finally the resinous coating is washed off, and the bars are ready for the plating operations.

It is evident from this brief description that a considerable capital investment in equipment is necessary. Management does not invest this amount of money unless it can foresee reasonable returns. One return that it may expect is a very high production. The through feed of stock in a typical setup is 40–45 ft/min. Automotive bumper bars for an example are about seven feet long, and allowing a small space between bars it is possible to finish five per minute or three hundred per hour, which is high production. This rate is made possible by the extremely rapid stock removal by the first few roughing heads which must remove all surface defects and provide a uniform finish for the intermediate heads. It may be necessary to remove 0.0015–0.003 inch of steel from the entire surface to accomplish this.

A second return on the investment that may be expected is a reduction in the amount of hand labor. It has been stated by a man responsible for an operation of this kind that it would take 180 men to finish by the old method the number of bars that 12–15 men can do by flat polishing.

A third return, which is more indirect, is the uniform finish produced from piece to piece and from day to day. It is obtained because of the mechanized operation, employing factory-coated abrasive belts.

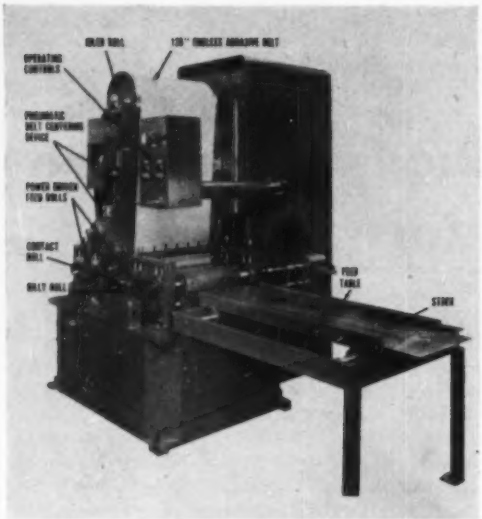

Fig. 1. Belt-polishing machine for polishing flat surfaces. Courtesy The Hill Acme Company, Cleveland, Ohio

It may be worthwhile to describe in some detail a flat belt-polishing machine and how it operates. As shown in Fig. 1, the cutting medium is an abrasive-coated belt mounted vertically above the work. The belt is supported at the top by one or two tension and tracking idler rolls, depending on the make of the machine. The grinding contact is made at the bottom of the belt which is supported and driven at this point by a rubber-covered contact roll. Grinding pressure is supplied by a floating steel billy roll mounted directly below the contact roll. This is "floated" on air cylinders and forces the steel up against the moving belt. Through feed of the stock is accomplished by pinch rolls, one set being mounted on the entrance side of the machine and one on the exit side. The entrance pinch rolls serve to force the stock between the belt and the billy roll, those on the exit side to pull the steel through and deliver it to the next machine.

The machines may be operated with coolants, or they may be used dry.

They are set up in tandem in either one of two systems. The first is a continuous system in which the machines are all in one line and the unpolished stock is fed into one end and comes out at the other end with the final polished finish. The second is a two-step system. In it the three or four roughing heads are installed separately from the twelve to fifteen intermediate and finishing heads. The stock is fed through the roughing stands as often as necessary to remove all surface imperfections. In this way one can make sure that all sheets sent to the finishing line will be free from defects and of uniform finish so the number of rejects or reruns necessary after polishing will be very small.

The machines can be selected to handle almost any size of flat stock. For example, putty-knife blades are being polished on small machines while sheets up to 48 inches wide by 2½–10 feet long can be polished on large machines.

The success of this method depends on the ease of polishing any flat or straight surface as compared to similar material which is curved or contoured. As an example, it is inherently easier to polish a piece of straight wire than a cork screw made from the same wire.

Manual Belt Polishing with Backstands

Manual polishing by the belt-backstand method after forming or casting was developed during the war and has found wide acceptance in the post-war era.

The equipment (Fig. 2) consists of a contact wheel mounted on an existing polishing lathe in the place of a setup wheel. The coated abrasive belt is tracked over the contact wheel by means of the backstand idler mounted behind the lathe. The polishing is done on the belt where it is supported and driven by the contact wheel, and the work is held in the same position as on setup wheels. The contact-wheel design affects both the cutting action and life of the belt, the harder wheel producing the deeper cut and the softer wheel the higher polish. More abrasive area is put to work with existing equipment; for example, a standard-length (14-feet) backstand belt has about four times the abrasive area of the usual setup wheel (14-inch diameter) of the same width.

The belt-backstand method is used for grinding, rough polishing, fine polishing and "oiling out" in preparation for buffing or plating.

There are four major benefits to be derived from this method as compared to older methods. Most important is the extremely fast rate of cut, which is due primarily to the fact that the coating technique makes the factory-coated abrasive belt inherently

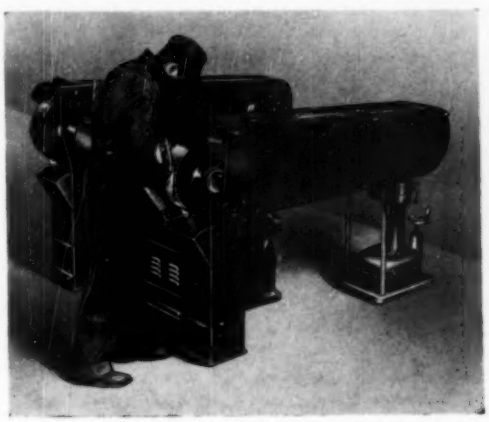

Fig. 2. Back-stand belt polishing. Courtesy The Hammond Machinery Builders, Inc., Kalamazoo, Mich.

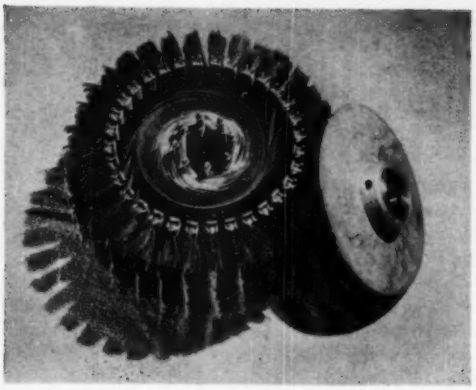

Fig. 3. Brush-backed polishing with abrasive-coated strips. Courtesy Vonnegut Moulder Corporation, Indianapolis, Ind., and The Carborundum Company

sharper than either grinding wheels or setup wheels. This has been clearly demonstrated in our Grinding Laboratory. We used a regular belt-backstand setup with a hard-rubber-covered contact wheel and a 36-grit belt traveling at 7,000 surface feet per minute. In preparation for the test, the operator selected a piece of 1-inch-diameter cold-rolled steel and marked it off in 1-inch lengths with a hacksaw. Then with stop-watch timing he forced the end of the bar against the moving belt and continued grinding until 1 inch had been removed. Many men familiar with grinding have guessed the time required to be between 2 and 12 minutes as compared to the 25 seconds that it actually takes.

The fast cut results in less time per piece per operation and hence lower labor cost per piece and higher production per day per man.

A second benefit is that it is frequently possible to reduce the number of operations necessary to produce a certain finish. This is done by skipping one or more grit sizes and so taking longer steps between operations. Nonferrous metals may frequently be taken directly to the finishing operation after deburring. To illustrate, there is a concern in central New York that manufactures silverplated gravy bowls. These are deep drawn from nickel silver and were formerly polished with a 180-grit setup wheel followed by a 220-grit greased setup wheel. By changing to the belt-backstand method, it was possible to leave out the 180-grit operation and produce the finish required for plating with a 220-grit greased belt.

Many steel articles are different in that they do require rough polishing. A typical example is a job in Ohio where forged-steel bicycle cranks are being polished. These are rough forgings with most of the flash trimmed off. They are rough polished on a backstand lathe with a 60-grit belt and then go directly to final polish with an 180-grit belt. At least one intermediate operation would be necessary if setup wheels were used.

A third benefit of this method is better finish, due largely to the superior coating on abrasive belts as compared to setup wheels. Another factor is that the correct contact wheel may be selected for each job. These can be generally classified as hard, medium, soft and pleated buffs. The hard wheels are used for rough polishing where stock removal is more important than finish. The medium and soft wheels are used for fine polishing or "oiling out" of flat surfaces. The pleated-buff type of contact wheel is used for either rough or fine polishing of contoured surfaces that the harder wheels will not handle satisfactorily. Contact-wheel action, cushion and effectiveness are generally stable and unchanging.

The fourth benefit to be derived from the use of this method is that less experienced help is required. It is possible to train an average workman to do satisfactory work with belts in one week's time, whereas it may take years to develop an expert polisher on setup wheels. This long training period is one reason why good polishers are so scarce at present. Training is easier with belts because the contact wheel maintains its shape, diameter and action. Also, the coating on the belt and the rate of cut are more constant. To illustrate, the aforementioned bicycle cranks were rough polished in 25 seconds with a new belt and 30

Fig. 4. Details of construction of brush-backed sander head. Courtesy Vonnegut Moulder Corporation, Indianapolis, Ind., and The Carborundum Company

(Continued on page 383)

JOB SHOP PLATERS CONFER WITH U. S. DEPARTMENT OF COMMERCE

A conference was held in Washington, D. C., on September 30, 1949 between representatives of the National Association of Metal Finishers and the U. S. Department of Commerce to discuss the problems of the job-plating industry.

Government representatives present at the conference were James L. Kelly, William L. Beck, D. M. Crin, J. C. Dockeray, F. H. Hayes, Charles F. Helsper, Charles F. Hughitt, L. B. Kilgore, Nelson A. Miller, H. E. Way, all of the O. D. C.; Dr. William Blum, National Bureau of Standards; F. E. Hilburn, O. T. S.; C. H. Olsen, Bureau of the Census; and Captain E. R. Henning, N. S. R. B. Industry representatives were B. M. Baur of Advance Plating Company, Chairman of the Committee; Raymond M. Shock, Executive Secretary, N. A. M. F.; James T. Bolan of Gerity Michigan Corporation; and William F. Walton of Walton and Lonsbury.

The following topics were covered:

1. To have the industry recognized by the government rather than being classified along with shoe and bicycle repair shops, it was decided that the Industry Committee will prepare a questionnaire embodying the points upon which it wishes to develop factual information. The questionnaire will then be presented to the Machinery and Transportation Equipment Division of the Department of Commerce, whereupon the Government officials present at the conference will study the questionnaire, make additions required to bring out information wanted by the department, suggest changes in the industry presentation, and resubmit the revised questionnaire to the Committee together with an estimate of the cost to industry for making the survey. It was explained that there would be no charge for supervision but only for extra expense involved in getting out the questionnaire and in tabulating, analyzing, and preparing the data in the form of a report.

2. At this time, depreciation is allowed in from five years to thirteen years, while the equipment manufacturers claim that an allowance of seven years should be made. The fact that the Department is on record through the statement "sound depreciation policy for small business" was regarded by the Association as sufficient assurance of the Department's concern with this subject.

3. In regard to ways and means of having the industry show its capacity in order that manufacturing companies do not install plating equipment which would be later used in competition with the job shops, it was concluded that the proposed survey of the industry is expected to provide sufficient detail as to plant capacity and major equipment installed in each plant to produce the data required.

4. Information on contracts let by the government for materials requiring metal finishes can be had from the Department's field offices.

5. Dr. Blum agreed to supply the Association with copies of government specifications for standard grades of electroplating which are of interest to the membership and which the Association may wish to add to its Manual. The individuals and divisions receiving copies also agreed to submit to the Association their comments and suggestions in connection with the improvement of the Manual.

6. The next edition of the Association's Directory will be improved, especially as to classification and indexing, and pointed toward making it more valuable to procurement agencies. Still greater improvement will be made possible after the survey of the industry makes available comprehensive data on facilities and capacities of the individual shops. Action on revising the Manual was expected on January 9, the date of the annual meeting of the Association's directors.

7. In regard to financing of job plating shops with government assistance (most companies lacking proper finances and being unable to secure loans when needed) it was concluded that there are normally many shops whose owners lack the managerial and sales ability required in times of stern competition. The industry is now overexpanded for present demands made upon its facilities, and until some such facilities have been removed through failures or other modes of elimination, it can be expected there will be extreme difficulty in making bank or government loans generally available. Some larger companies are more concerned with securing orders on which to utilize available funds than with obtaining funds to carry on operations. Liberalization of conditions under which government loans could be made to members of this industry would have to be authorized by legislation.

8. In connection with the effort to educate the small job-shop owner in the art of doing business, Mr. Hilburn arranged to send to the Association a number of microfilm reels on plating which are considered to be among the best material secured by industry teams sent by the Office of Technical Services to Germany after VE Day.

9. Some business failures are due to unfair competition which stems from lack of knowledge of the cost of doing business. To eliminate such competition, education will in the future be centered on the value of adherence to standard specifications. Efforts to educate the public as to plating quality would also help greatly.

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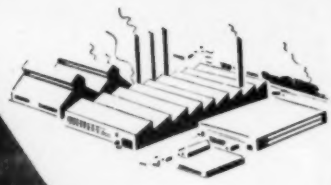

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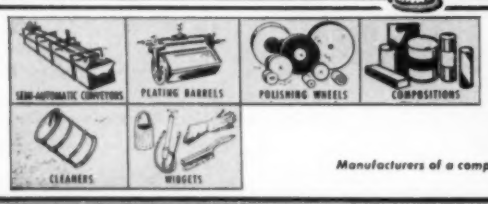

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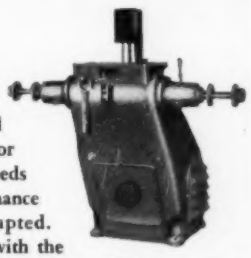

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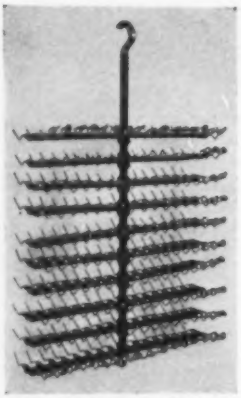

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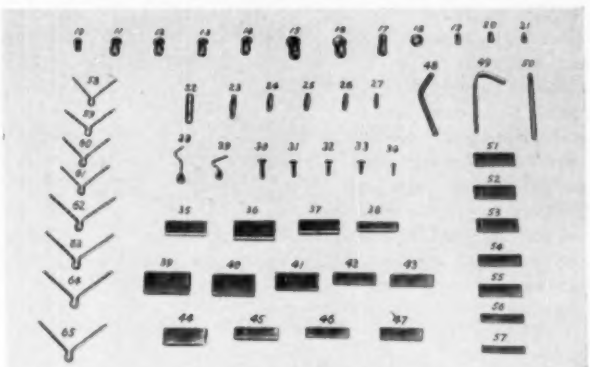

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Adherent Electrodeposits

(*Continued from page 374*)

cent chromium for deposition of nickel by the initial processes; however, work on this is incomplete. The current distribution problem arising from having a thin base coating of pure chromium is difficult because the resistance of the surface is approximately five times that of the 90 per cent chromium alloy.

ACKNOWLEDGMENT

The author is grateful to Dr. Sherlock Swann, Jr., for his interest in the work described in this paper.

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Some Modern Methods

(*Continued from page 377*)

seconds when the belt was ready for discard. Similarly, certain diecastings were deburred in 6 seconds with a new belt and in 7 seconds when the belt was worn out.

Another factor which makes training easier is that work with belts is less fatiguing. The operator is less tired at the end of the day and can continue to do high-quality work during a greater part of the day.

Brush-backed Polishing

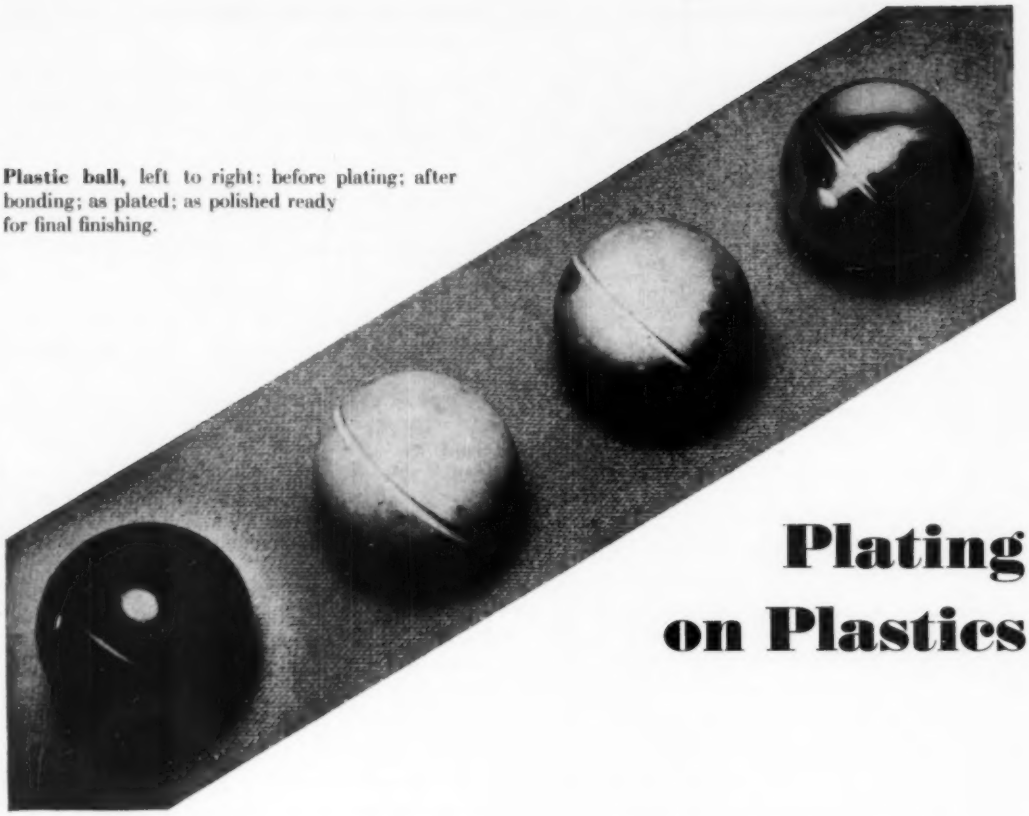
In manual polishing by the brush-backed sander-head method the sander head (Fig. 3) is constructed largely of steel, is about 12 inches in diameter and is made in 2–4 inch widths. Around the periphery of the wheel are mounted 32 brushes, and strips of coated abrasives protrude from the inside of the wheel in front of each brush, projecting slightly beyond the brush tips. The head is mounted on a polishing lathe in the same manner as a setup wheel and rotated at 1750–2000 rpm. The brushes provide a flexible support for the coated abrasive as it contacts the work.

This is a comparatively new tool in the metalworking field but has been in use for years in the woodworking shops, where it is used for sanding such things as mouldings and carvings. Being flexible in action, it is particularly effective on contoured pieces (Fig. 4) and may be used both on ferrous and nonferrous metals. Its principal field is in competition with charged buffs. It is a prebuffing or blending tool and is not considered suitable for stock removal. The finish produced is of a satin type as contrasted with the straight-line scratch pattern made by a polishing belt.

The advantage in using the brush-backed sander head is in a substantial saving over charged buffs. This is due chiefly to the fact that the abrasive particles are held in place on the cloth backing and made to work. With charged buffs, much of the abrasive is thrown off and does not do any work.

The head is adaptable to various contours either on different pieces or on different areas of the same piece. It is also flexible in the surface finish produced. Abrasive loadings for the head are available in two general types—aluminum oxide and silicon carbide. The former may be had in from 50 to 400 grit; the latter in from 50 to 600 grit. By using the wheel dry or with a grease stick, one may obtain an even greater variety of finishes. For example, in the polishing of alloy-steel turbine blades it has been possible to produce a 3½-microinch finish by using 600-grit silicon carbide loadings.

Development is continuing in belts, machines, contact wheels and rolls, and in the techniques of using them. A large part of this development work is being done by the users of the methods, who deserve much of the credit for what has been and is being accomplished.



Plastic ball, left to right: before plating; after bonding; as plated; as polished ready for final finishing.

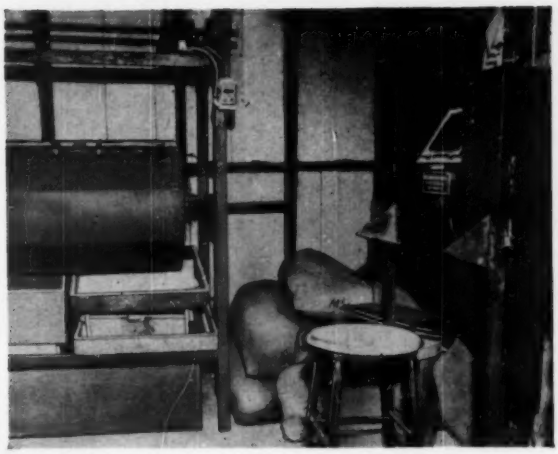
Plating on Plastics

ELECTROPLATING on nonmetallics goes back almost to the beginning of electrodeposition. Thus it was in 1835 that von Liebig discovered how to silver glass and in 1837 that Jacobi learned how to make metal molds by plating on wax and stripping the deposit. Development and refinement of a great number of processes followed, but except for plating on mirrors and electrotype making, plating on nonmetallics remained a fine art. It did not approach the mass production stage until plastics had found general acceptance and the value of plated plastics had been recognized.

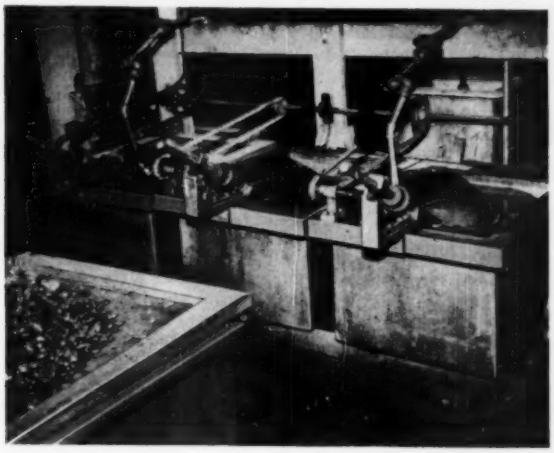
The following description of the plant of Plastiplate Company, Inc., South River, N. J., was furnished by its president, Mr. Bernard F. Walker. He became interested in the manufacture of electrical and electronic parts by combination of metal and an insulating material while still going to school, in 1936. After three years of research and pilot-plant studies he had not only solved the original problem but also developed methods for bulk plating in barrels of small plastic parts—buttons, beads, charms, radio knobs, bottle caps, and hundreds of similar items. The war reversed the trend temporarily from novelty items and the like back to electronic equipment—antennae masts of copper plated compressed impregnated wood, turret swivel joints, junction boxes, and the like—which because of their light weight became invaluable for aircraft. Military insignia and discharge buttons of plastics were also plated in large quantities.

The plant described here was set up after the war and embodies the results of ten years' experience. It has a barrel plating capacity of over one million small parts a day and limited facilities for tank plating of larger pieces. The methods employed are flexible, as different plastic materials and different types of articles require different treatments. While consistent results are being obtained, much depends on the ability of key personnel to select the right sequence for the job on hand.

In plating on most plastics the four basic steps are (1) surface treatment to insure wetting and adhesion of the bond coat (conductive film), (2) application of the bond coat, (3) plating, and (4) finishing.

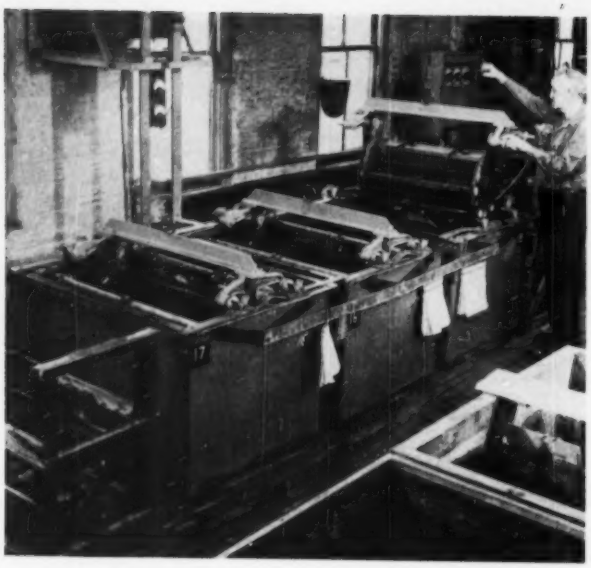


Mechanical surface treatment may be done by wet or dry tumbling (left) or by sand blasting (right). Chemical methods include immersion in strong alkali, acid or solvent which attacks the plastic surface in a controlled manner.



Bonding setup for small parts. The bond coat is applied by immersion in or spraying with succession of solutions for cleaning and wetting the surface, sensitizing it, and finally deposition of silver or copper by chemical reduction.

Batch of bond-coated plastic parts is tested with an ohm meter to make certain that the surfaces are properly conductive. Any load showing a resistance of 0.25–5 ohms is considered satisfactory.

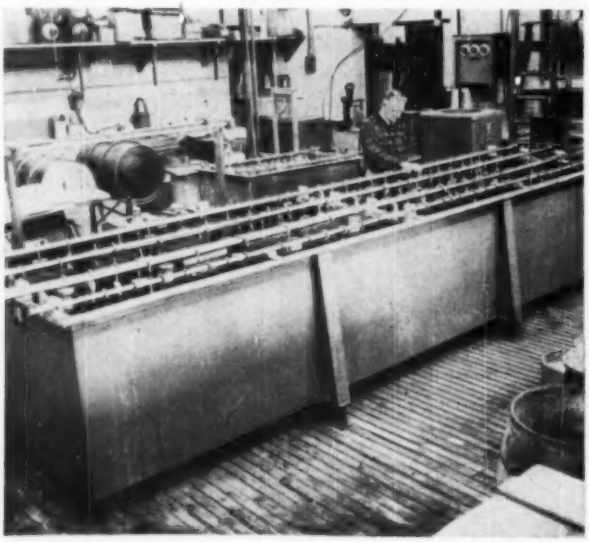


Horizontal barrels for copper plating bonded plastic parts in quantity. Thicknesses of 0.001 to 0.003 inch are applied on most articles to permit necessary polishing and finishing.

An oblique copper plating barrel for small lots. While copper is most commonly used, silver, nickel, lead and other metals are also deposited, for special applications.

Finishing procedures for base-metal-plated plastic parts are almost identical with the procedures for solid metals, i. e., large parts are finished on wheels and small parts in tumbling barrels. Here a burnishing barrel, in which the parts have been rolled with steel balls and soap solution, is being unloaded. Many parts which would be too fragile or intricate for burnishing if made of metal can be burnished satisfactorily if made of plastic because of its lightness and elasticity.

Sixteen-foot copper plating tank with cathode rod agitator for racked parts.



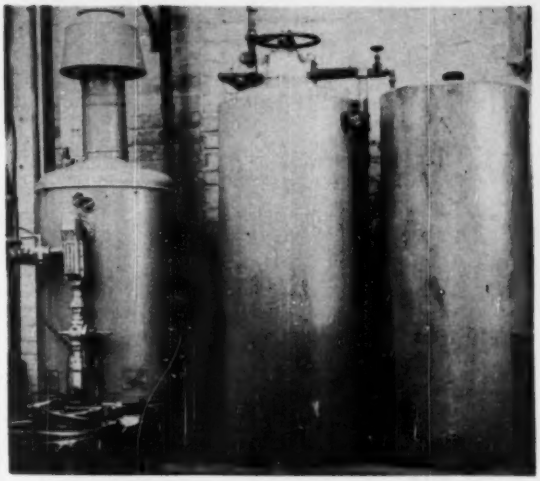
Clockwise:

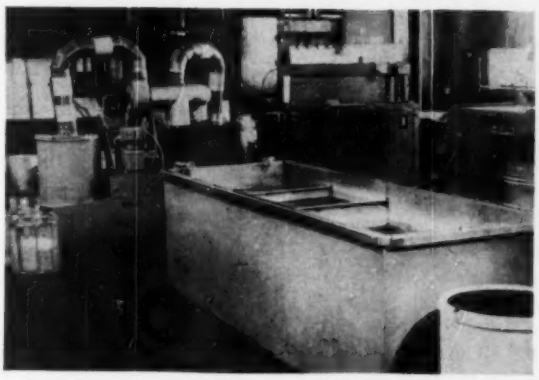
This water-treatment equipment softens and heats water for use in burnishing and final rinsing.

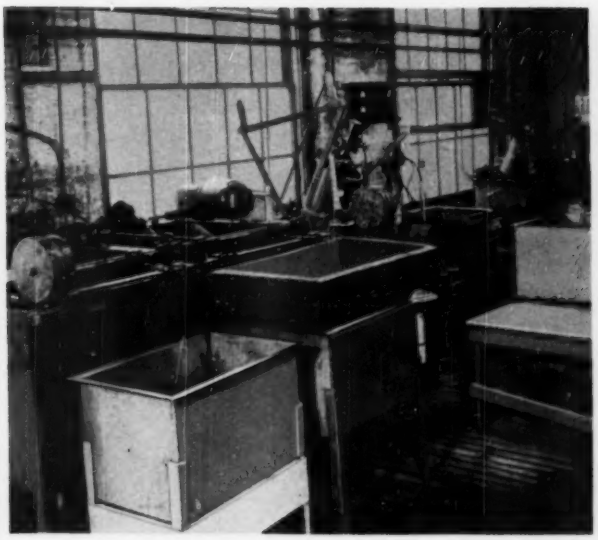
Four-section final-rinse tank of stainless steel with centrifugal-drying equipment in background.

The polished or burnished part may be plated with nickel, chromium, brass, or any other metal as required. This section has the equipment used for silver and gold plating in barrels.

All gold, silver, and copper plated parts are protected with a coating of clear lacquer. Here small parts are lacquered in centrifugal equipment.





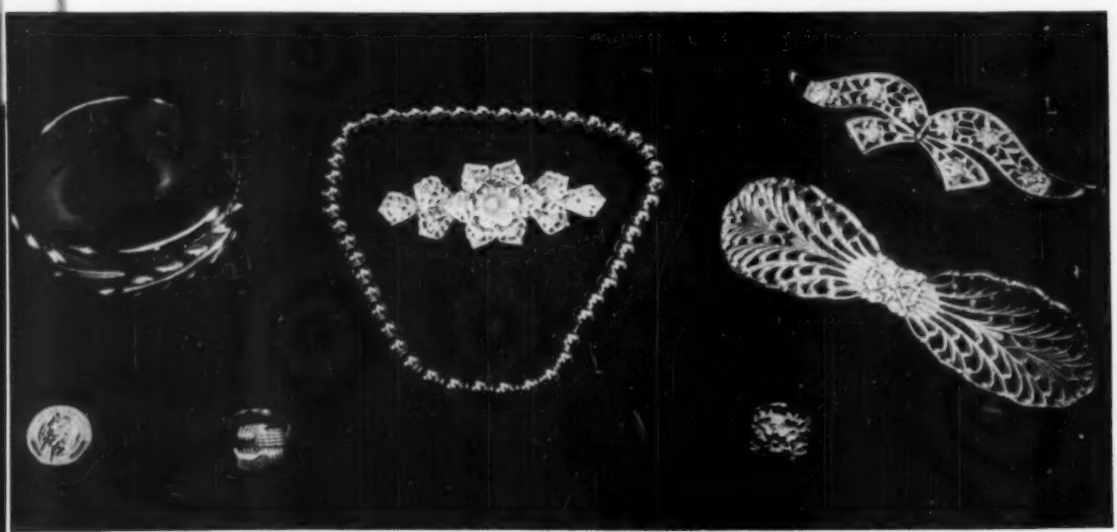


Finished parts in bins are being inspected.

A testing bench is located in plating room for analysis of solutions and control of quality.

Corner of research and development laboratory for study of new bonding and plating methods.

Plated plastic jewelry. Cover picture shows other products; from extreme left, clockwise: radio control dial in brushed-finished brass, lipstick case, chromium plated and gold plated radio knobs, golf tee, perfume bottle with plated cap, chromium plated soda mixer head; center: jar cap



project no. 2

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*AUTHORS

Determination of Impurities in Electroplating Solutions

XVIII. TRACES OF CHROMIUM IN COPPER PLATING BATHS

The purpose of this investigation was to develop a simple, rapid and inexpensive method for quantitative determination of chromium in copper plating baths which might be contaminated by small amounts of Pb, Fe^{+++}, Ag, Al, Ni, Na, SiO_2 and organic material.

In the analytical literature, there are many references pertaining to colorimetric methods for the determination of very small amounts of chromium. The majority of these methods have been developed mainly for the analysis of ores and steels. One method depends upon the measurement of a pink to cherry-red color formed by the reaction of hexavalent chromium and disodium 1, 8-dihydroxynaphthalene 3, 6-disulfonate[5-7]. Chromium can also be determined by oxidizing it to chromate by persulfate and silver nitrate[8,9,10] or by potassium permanganate[3] and comparing the yellow color produced with a standard chromate solution.

A reference to the determination of chromium in plating baths was made by Foulke[4] in which the use of diphenyl carbazide was recommended. The reaction between hexavalent chromium and diphenylcarbazide producing a strong red-violet-colored product was chosen as the basis for a colorimetric method for the determination of chromium[10,11,2,1]. Serfass and Levine[12] used this method for the determination of chromium in nickel plating baths. As stated by Serfass and Levine, the method has the following advantages:

1. The reaction is very sensitive.
2. There are comparatively few other elements that form intensely colored compounds with the reagent; Mo^{+6}, Hg^{+1}, Hg^{+2}, Fe^{+3} and V^{+5} all interfere to some extent, the first three being most disturbing.
3. The color is developed in a dilute solution of mineral acid—usually sulfuric—without the use of buffers, complexing agents, or extractions.

This investigation of the use of diphenylcarbazide is divided into two parts: the development of methods for the determination of (a) chromate chromium and (b) total chromium present in the bath.

Determination of Chromate Chromium

Development Work

Since the conditions under which the chromate ion reacts with diphenylcarbazide are well known, the only problem requiring investigation was the possible interference of copper and iron that may be present in the plating bath.

Interference is produced by very few inorganic substances. However, one of these is iron. It is known that if either a green filter or a wave length of 460 mμ or above is used[11], iron interferes very little. Even twenty times as much iron as chromium will not interfere if a wave length of 540 mμ is employed. At times, the quantity of iron present may be well over twenty times the amount of chromium and therefore would introduce serious difficulty. An error of ± 2 per cent is easily introduced due to this fact alone unless the calibration curve is made with the same amount of iron present.

TABLE I. EFFECT OF COPPER CONTENT ON COLORIMETER READINGS

Sample: 25 ml containing 50 micrograms CrO_3

Pure Copper Bath Added ml	Copper Content mg 25 ml	Colorimeter Reading
2	104	150
1	51	250
0.5	26	272
0.25	13	280
0.125	6	275
0	0	385

To minimize this error, phosphoric acid is added which forms a stable complex with iron[5] thus preventing the iron reacting with the diphenylcarbazide. Iron phosphate has little or no interference, and this method will therefore have a higher precision.

The fact that copper forms a colored complex with diphenylcarbazide has been known for a long time. In the literature, it was found that copper reacts with diphenylcarbazide in neutral solution but not in acid solution. However, in a copper plating bath, there is a considerable excess of copper, over 1000 times more copper than chromium, so that some of the copper does react with the diphenylcarbazide even on the acid side.

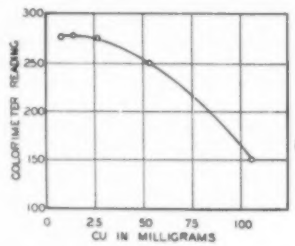

Fig. 1. Effect of copper content on colorimeter readings on bath containing 50 micrograms chromic acid. Colorimeter: Klett-Summerson with green filter No. 54. Final volume of solution: 25 ml

TABLE II. CALIBRATION CURVE FOR CHROMATE CHROMIUM

CrO_3 microgram	Colorimeter Readings	Average Reading	Blank	Corrected Average Reading
0	10, 15, 12	12	..	12
10	55, 60, 65	60	12	48
20	115, 113, 118	115	12	103
30	160, 155, 158	158	12	155
40	220, 225, 222	223	12	221
50	275, 280, 270	275	12	263

The next step after it had been realized that the copper reacted with the diphenylcarbazide was to run a series of tests to determine if a quantitative method could be devised without first removing the copper.

A series of tests were therefore made in which diphenylcarbazide was added to 25-ml solutions containing 50 micrograms of chromium and varying amounts of copper. The results are shown in Table I and also graphically in Fig. 1.

It can be seen that within a certain range of copper concentration—1/8–1/2 ml of copper bath or 6–26 mg of copper—the effect of the copper diphenylcarbazide is constant. The proof that it is the copper diphenylcarbazide complex hat interferes and not the copper sulfate itself is found in a comparison between curves C and D in Fig. 2 which shows that $CuSO_4$ itself absorbs practically no light at 520 mμ.

The exact mechanism for the reaction of chromic acid or copper with diphenylcarbazide is not clearly understood, but for the purpose of this investigation it was felt to be sufficient to show that within certain limits the presence of copper will not prevent accurate results.

If a concentration of copper between 6 and 25 micrograms is chosen, the error is constant. Hence a calibration curve can be made and used for calculation of unknown amounts of chromium without any error being introduced.

Preparation of Calibration Curve for Chromate Chromium

To prepare the calibration curve, 0.5 ml of the pure standard copper plating bath (26 mg copper) was pipetted into each of six 25-ml volumetric flasks, and 0, 5, 10, 20, 30, and 50 micrograms of CrO_3 added as potassium dichromate to each flask respectively. Then were added to each flask, in order, two drops of nitric acid, 15 ml of water, 0.5 ml of phosphoric acid, and 1 ml of 0.25 per cent diphenylcarbazide solution, and the solutions were diluted to the mark with pure distilled water.

With distilled water as the reference liquid, the transmittancy of each solution was measured using a Klett-Summerson colorimeter with the green filter No. 54. This filter was selected because its maximum absorption band corresponds to that of the chromate diphenylcarbazide-colored system. The transmittancy curves for the filter and the chromate diphenylcarbazide system are shown in Fig. 2, curves A and B. The data were obtained with a Beckman spectrophotometer.

The data for the calibration curve are shown in Table II.

By plotting the corrected readings against the corresponding amounts of CrO_3, the curve shown in Fig. 3 was obtained. The resulting straight line indicates that Bouguer-Beer's law is obeye din the concentration region tested.

Recommended Routine Procedure for Chromate Chromium

Solutions Required

1. Standard CrO_3 solution—10 micrograms/ml
   Dissolve 147 milligrams of pure potassium dichromate in 1 liter of pure

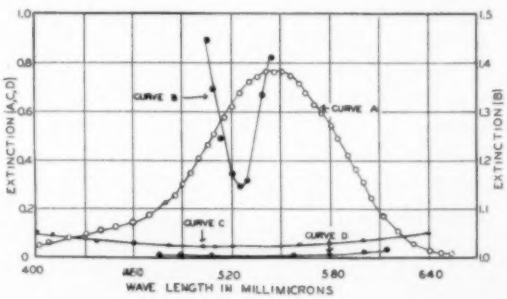

Fig. 2. Extinction vs. wave length for (A) chromate-diphenylcarbazide complex of 50 micrograms chromic acid per 25 ml solution, (B) Klett-Summerson green filter No. 54 (extinction units on the right), (C) copper-diphenylcarbazide complex of 26 mg copper per 25 ml, and (D) copper sulfate solution containing 26 mg per 25 ml

distilled water by filling a liter flask to the mark. Take 10 ml of this stock solution and dilute it to 100 ml in a 100-ml volumetric flask by adding distilled water to the mark.

2. Standard plating bath
   Dissolve 204 grams of cp $CuSO_4 \cdot 5H_2O$ and 25 ml of concentrated H_2SO_4 in distilled water and dilute to the mark in a 1-l volumetric flask.
3. Diphenylcarbazide solution—0.25 per cent
   Dissolve .25 grams of the reagent in 100 ml of absolute alcohol. Prepare the reagent fresh every day.
4. Sulfuric acid—about 6 *N*
   Dilute 10 ml of concentrated H_2SO_4 to 60 ml with pure distilled water. Add $KMnO_4$ solution until just pink.
5. Nitric acid—cp concentrated
6. Phosphoric acid—concentrated (85 per cent)

Apparatus Required

1. Pipettes
2. 25-, 100- and 1000-ml volumetric flasks
3. Klett-Summerson colorimeter with green No. 54 filter or any spectrophotometer

Procedure

1. Using a good fractional pipette, add 0.5 ml of the impure bath to be tested into a 25-ml volumetric flask.
2. Add 2 drops of nitric acid from a dropping bottle and shake the solution well for about a minute. Then add about 15 ml of water.
3. Add 0.5 ml concentrated phosphoric acid and shake for one minute.
4. Add 1 ml diphenylcarbazide solution and shake until the color becomes intense.
5. Using distilled water as reference liquid, measure the transmittancy of the solution and take the maximum reading attained if pointer shifts slightly. Take reading immediately after color development.
6. Add diphenylcarbazide solution to 0.5 ml of the pure standard copper plating bath (reagent 2) and make a reading. Subtract this blank reading from the sample reading.
7. Look up the corrected scale reading on the calibration curve. The amount of CrO_3 corresponding to it is the quantity of CrO_3 in the volume of the bath originally taken for analysis.

Determination of Total Chromium
Developmental Work

The simplest method of determining the total concentration of chromium—hexavalent plus trivalent—in the copper baths seemed to be to oxidize the Cr^{+3} to $CrO_4^{=}$ and then use the diphenylcarbazide reaction to complete the reaction. Of the methods available to oxidize Cr^{+3} to $CrO_4^{=}$ in acid solution, the most commonly used are oxidation with perchloric acid[9,14] and oxidation with ammonium persulfate in the presence of silver ions[8,12].

However, oxidation is not complete by any one method alone. Oxidation with perchloric acid gives only 50 per cent oxidation. To insure complete oxidation, the following combination of oxidizing methods are necessary: oxidation by mixed perchloric, sulfuric and nitric acids followed by oxidation by ammonium persulfate in the presence of silver ions. The Fe^{+++} must be removed by cupferron to insure complete oxidation of the chromium by this method.

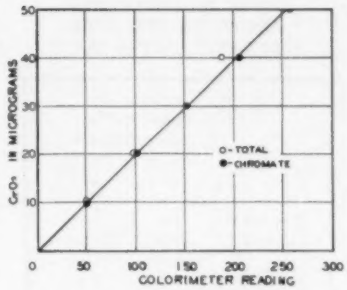

Fig. 3. Calibration curve for determination of chromium (in terms of chromic trioxide) in copper baths (acid copper sulfate bath used) by the diphenylcarbazide method. Instrument used: Klett-Summerson colorimeter with green filter No. 54. Final volume of solution: 25 ml

Preparation of Calibration Curve for Total Chromium

To prepare the calibration curve for total chromium, 0.5 ml of pure copper bath and 0, 10, 20, 30, 40, and 50 micrograms of CrO_3 added as reduced $K_2Cr_2O_7$ were pipetted into six 25-ml Erlenmeyer flasks respectively.

The solutions were treated as described under "Recommended Routine Procedure for Total Chromium" heading below. The data obtained are shown in Table III, while the curve obtained by plotting the corrected readings against the corresponding amounts of chromium as CrO_3 is shown in Fig. 3.

The resulting straight line in Fig. 3 again indicates that the Bouguer-Beer's law is obeyed in the region of 0–50 micrograms of chromium as CrO_3. It can be seen that the presence of copper does not interfere with the oxidation of Cr^{+3} to $CrO_4^{=}$, and therefore the same calibration curve can be used for the determination of both hexavalent and total chromium.

Recommended Routine Procedure for Total Chromium

Solutions Required

1. Ammonium persulfate—cp grade
2. Amyl acetate—pure
3. Cupferron—1 per cent
   Dissolve 1 gram of the reagent in water and dilute to 100 ml. Keep the solution cool.
4. Sulfuric acid—about 6 *N*
   Dilute 10 ml of concentrated sulfuric acid to 40 ml. Cool and dilute to 60 ml.
5. Perchloric acid—70 per cent
6. Nitric acid—concentrated
7. Silver nitrate—0.05 *N*
   Dissolve approximately 1 gram of the cp grade salt in water and dilute to 100 ml.
8. Hydrochloric acid—1:5
   Dilute 10 ml concentrated hydrochloric acid to 60 ml with distilled water.
9. Diphenylcarbazide solution—0.25 per cent
   Dissolve 0.25 gram of the reagent in absolute alcohol and dilute to 100 ml. Prepare the reagent daily.
10. Standard chromium solution—10 micrograms CrO_3/ml
    Dissolve 147 mg pure $K_2Cr_2O_7$ in about 100 ml of distilled water and dilute with distilled water to 1 liter in a volumetric flask. Pipette 10 ml of this stock solution into a 100-ml volumetric flask and dilute with distilled water almost to mark. Add 1 drop concentrated H_2SO_4 and a small crystal of sodium sulfite. Shake until the solution appears colorless. Complete dilution to the mark.
11. Standard copper plating bath
    Dissolve 204 g of cp $CuSO_4 \cdot 5 H_2O$

TABLE III. CALIBRATION CURVE FOR TOTAL CHROMIUM

CrO_3 microgram	Colorimeter Readings	Average Reading	Blank	Corrected Average Reading
0	13, 12, 12	12		12
10	63, 60, 65	63	12	51
20	110, 115, 105	110	12	98
40	190, 195, 193	193	12	181
50	273, 275, 278	275	12	263

and 25 ml concentrated H_2SO_4 in distilled water and dilute to the mark in a 1-l volumetric flask.

Apparatus Required

1. Squibb-type separatory funnels of about 60-ml capacity
2. 50-ml Erlenmeyer flasks
3. Small watch glasses for covering the flasks
4. Pipettes
5. Dropping bottles
6. Centrifuge
7. Any suitable spectrophotometer or colorimeter as explained in the chromate-method procedure
8. Volumetric flasks of 25-, 100- and 1000-ml capacity

Procedure

A. Removal of the Iron

1. Using an accurate fractional pipette, transfer 0.5 ml of the impure bath to be tested to a separatory funnel.
2. Add 5 ml of distilled water followed by 1 ml of cold cupferron. Shake for about 30 seconds.
3. Extract the iron cupferride with 5 ml of amyl acetate. Transfer the aqueous layer to another separatory funnel and extract a second time with another 5-ml portion of amyl acetate.
4. Transfer the aqueous layer to a 50-ml Erlenmeyer flask. Combine the amyl acetate layers and wash with 5 ml of distilled water. Run the wash water into the flask containing the sample and discard the amyl acetate extract.

B. Oxidation of the Chromium

5. Add 2 drops of $HClO_4$, 1 ml 6-*N* H_2SO_4 and 1 ml of concentrated nitric acid, and mix
6. Place the flask on a hot plate, cover it with a watch glass, and fume for a few minutes. Remove when salts begin to appear.
7. Add 7 ml of 0.05-*N* silver nitrate and then 0.3–0.5 g solid ammonium persulfate. The addition of the silver nitrate cools the solution sufficiently so that there is no spattering when the oxidizing agent is added. If there is no manganese in the sample, add 1 drop of 0.1-*N* $KMnO_4$.
8. Boil gently for about 10 minutes, keeping the *volume around 5–7 ml.* If it gets below about 5 ml, add a few ml of distilled water.
9. Add 2 drops of 1:5 hydrochloric acid and digest for 3–5 minutes. If the permanganate is not completely reduced, add 1–2 drops more and digest again. A third addition may be necessary. Keep the volume up to 5–7 ml.
10. When all the permanganate has been reduced, place the flask in a cold water bath to cool.

C. Development of the Colored System

11. Transfer the solution in the flask to a 25-ml volumetric flask. Wash the Erlenmeyer flask about 3 times with small portions of distilled water.
12. Add 1 ml of the diphenylcarbazide solution, dilute to the mark with water and shake well.
13. Almost fill a clean test tube with the solution and either centrifuge for 2 minutes to settle the suspended silver chloride or filter through dry Whatman No. 40 paper into a dry 30-ml beaker.
14. Pour a portion of the clear solution into a clean test tube and measure its transmittancy using distilled water as the reference solution. Make a reading without allowing the solution to stand around.
15. Along with the sample, run a blank in exactly the same manner. However, instead of the impure bath use the pure standard copper bath (reagent 11).
16. As in the chromate procedure, a Klett-Summerson colorimeter with a green filter No. 54 is used in measuring the transmittancy of the solution. If the instrument used has a wave-length selector, set it at 540 millimicrons.

TABLE IV. IMPURITIES ADDED TO THE PURE STANDARD COPPER BATH

Ion	Quantity mg/100 ml	Concentration g/l
Aluminum	100	1.0
Calcium	Saturated	Saturated
Lead	5	0.05
Iron	100	1.0
Silver	100	0.5
Nickel	100	1.0
Silicon (as SiO_3^{-2})	100	1.0
Sodium	200	2.0

Calculations

In both the chromate and total-chromium methods the element is in the hexavalent state, and all calculations are reported in terms of CrO_3 content in microgram/ml, ppm, or g/l.

In determining the total chromium concentration, subtract the blank from the colorimetric reading. Next, determine the concentration of CrO_3 this represents by checking the calibration curve. Since 0.5 ml of the bath had been taken, the concentration in mg/l or ppm is obtained simply by multiplying the number of micrograms by 2.

Since the chromate-diphenylcarbazide colored system follows Bouguer-Beer's law, the concentration of CrO_3 in an unknown can be determined without the use of a calibration curve by the application of the equation:

$$\frac{\text{conc. of standard}}{\text{corrected scale reading of standard}} \times \frac{\text{corrected reading of unknown}}{} = \text{concentration of unknown}$$

This equation can only be applied when the instrument used measures transmittancy in terms of extinction or in units proportional to the extinction.

Accuracy and Precision Attainable with the Methods

In order to check the accuracy and precision of the chromium methods under conditions comparable to those found in commercial work, small amount of various ions were dissolved in 100 ml of the pure copper bath, and the accuracy and precision were determined in the presence of these impurities. Table IV shows the ions and the quantity of each that were added to the bath.

The silica was added in the form of

TABLE V. ACCURACY AND PRECISION OF CHROMATE CHROMIUM METHOD

CrO_3 Added microgram	Corrected Reading	CrO_3 Found microgram	Error microgram	Error per cent
10	45	9.0	−1.0	10
20	103	20.0	0	0
30	146	28.5	−1.5	5
50	260	50.0	0	0
50	268	51.5	+1.5	3
50	261	50.0	0	0
50	263	50.5	+0.5	1
50	268	51.5	+1.5	3

$Na_2SiO_3.5H_2O$; the metallic ions as sulfates, nitrates, or chlorides. After the impurities had been added, the mixture was heated, shaken well, and cooled. It was then filtered to remove the insoluble salts, and the filtrate was used for the tests.

Table V shows the accuracy and precision obtained by means of the procedure for the determination of chromate chromium. The average accuracy of these readings of chromate chromium is 5 per cent, the precision of the method within 1 per cent.

As shown in Table VI the average accuracy and precision of the total-chromium method are both approximately 1 per cent.

An additional check of the accuracy of these procedures was made by sending samples of a test solution to several industrial concerns for analysis. The organizations which kindly consented to test the methods were Bethlehem Steel Company; United Chromium, Inc.; MacDermid, Inc.; and the Lea Manufacturing Company.

The results obtained at these laboratories as well as at Lehigh University are shown in Table VII. The excellent checks indicate that the method for chromate chromium and for total chromium can give quite good check results.

"Stop and Go" Methods

For those who want a visual-comparison method for determining chromium, the following is recommended:

1. Develop the color in an unknown and a blank in the same manner as described in the "Recommended Routine Procedures".

2. Transfer the solutions in the 25-ml flasks to 50-ml Nessler tubes. The tube for the blank should be filled to about 23 ml.

3. Add standard chromate solution from a burette to the blank with thorough mixing following each addition until the colors of the solutions in the tubes match when viewed transversely against a white background. The unknown then contains as much CrO_3 as is added to the blank solution.

For total chromium, allow the solutions to sit a few minutes after each addition of the standard solution so that most of the silver chloride precipitate has a chance to settle before the colors are compared.

Discussion

These methods for chromate and total chromium are accurate to 5 per cent. To insure this accuracy, the following critical points must be considered:

1. The concentration of the copper must be between 6 and 26 milligrams. If the copper concentration exceeds the higher value, dilution must be used until the concentration reaches this region. If this is not done, the method will be far from accurate. For a standard acid copper bath containing 204 g/l $CuSO_4.5H_2O$, 0.5 ml of bath will contain 25 milligrams of copper. If one does not have a fractional pipette for taking a 0.5-ml aliquot, transfer 10 ml of the bath to a 100-ml flask, dilute to the mark with distilled water, and use 5 ml of the solution for the determination.

2. The freshness of the diphenylcarbazide is another important factor. A fresh solution should be made daily. Upon standing, the solution changes from a pale pink to a deep red. If the solution has a red color, it should be discarded and a fresh solution made up.

3. In the total-chromium method the volume of the solution should be kept at 5–8 ml during oxidation with Ag^+ and persulfate and reduction of any manganese. If the solution is below 5 ml, erratic and low results are obtained. If the solution contains more than 8 ml, more time will be required for a complete oxidation.

If the above points are considered, accurate results are easily obtainable from the determination of chromium—hexavalent and trivalent—in copper baths.

TABLE VI. ACCURACY AND PRECISION OF TOTAL CHROMIUM METHOD

CrO_3 Added microgram	Corrected Reading	CrO_3 Found microgram	Error microgram	Error per cent
10	50	10.0	0	0
20	108	20.8	+0.8	4
30	155	30.0	0	0
50	263	50.5	+0.5	1
50	263	50.5	+0.5	1
50	258	50.0	0	0
50	260	50.0	0	0
50	263	50.5	+0.5	1

TABLE VII. RESULTS OBTAINED BY COOPERATING LABORATORIES

Laboratory	Chromic Acid, ppm	
	Chromate	Total Chromium
A	32	97
B	30	99
C	30	99
D	30	99
E	30	94

Summary

Methods for the determination of chromate chromium and total chromium in copper plating baths have been developed, which are accurate to 5 per cent if the copper concentration is kept between 6 and 26 milligrams.

In the determination of chromate chromium, the aliquot is transferred to a volumetric flask, a little nitric acid added to oxidize any reducing agents, phosphoric acid added to make a complex with Fe^{+++}, and diphenylcarbazide added to form a colored complex. The transmittancy of the solution is measured, and the amount of CrO_3 present as chromate is read off the calibration curve.

For the total chromium analysis, the iron is first removed by precipitation with cupferron and extraction with amyl acetate. The chromium is oxidized first by fuming with perchloric acid and then by boiling with ammonium persulfate in the presence of silver ions. The silver is precipitated with HCl, which also reduces any of the oxidized manganese. The solution is centrifuged, the transmittancy of the clear supernatant solution measured, and the amount of CrO_3 present as both Cr^{+++} and $CrO_4^{=}$ is read off the calibration curve.

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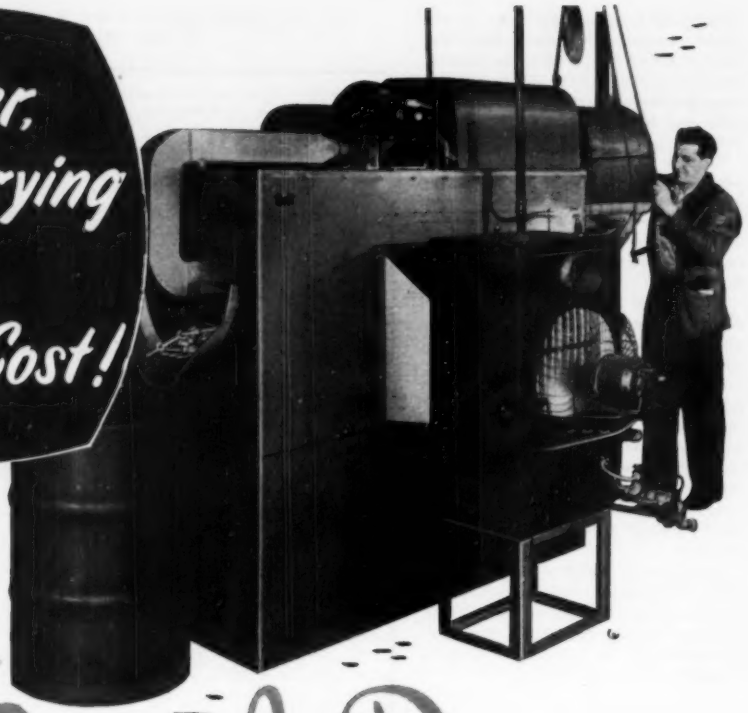

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readers' questions of general interest

Q. 81. Is there a U. S. rating for colonial hardware and, if so, where can it be obtained? We apply to the steel parts 0.0003–0.0004 inch zinc plate, treat with Ebonol Black for enamel adhesion, and finish with a 0.0005–0.0007 inch thick black baked enamel. The finish withstands 200 hours of salt spray.

A. There is no provision for a "U. S. rating" on hardware or similar articles. However, there are Federal Specifications for hardware that is purchased by the Government, the most recent of which are FF-H-106a and FF-H-111a. Copies of these may be purchased from the Superintendent of Documents, Government Printing Office for 25 cents. In these and other specifications for hardware references are made to certain standard finishes, which are listed on page 4 of Commercial Standard CS22–40, obtainable from the same source at 10 cents. The symbols and descriptions given therein refer solely to the type and appearance of the finish and not to the quality. The latter is defined in each specification for the electroplated finishes, for example, in terms of the thickness or salt spray resistance of coatings.

There is no specific reference to steel hardware that is zinc plated and coated with a black baked enamel. It is entirely possible that certain Government departments, especially the War or Navy Departments, may write specifications covering such a finish for a particular product and purpose, but there is no present Federal Specification.—W. Blum.

Q. 82. We have experienced difficulties with a crayon used to mark plating rejects for spot repolishing and replating. Where the crayon markings are not polished away, they show up after plating through the nickel and chromium. Where can we obtain a marking crayon that can be easily removed in an ordinary preplating cleaning cycle?

A. Two polished and buffed brass panels are enclosed. I wrote my initials on both of them, on one with Blaisdell China Marking Pencil No. 169-T, on the other with a Wilcohere Glass Marking Pencil. Both were then cleaned for one minute in a 6-oz/gal solution of Matawan 2W Cleaner at 190° F. The stain on the first mentioned panel was quite evident. We then dipped it for one minute in a 6-oz/gal solution of sodium cyanide, which increased the depth of the stain. Cathodic treatment in the same solution produced the still darker color which you can see. On the second panel the stain after alkali cleaning is only faintly visible. A wax with high iodine value or possibly the dye may be responsible for the staining.—M. B. Diggin.

A. A steel panel marked with a Dixon Lumber Crayon was alkali cleaned, acid dipped, and nickel plated. No sign of residue was noticed after plating.—A. K. Graham.

Q. 83. I am having trouble with tin plating from a sodium stannate bath. Although I add hydrogen peroxide at frequent intervals, the plate is spongy most of the time. What would you recommend?

A. Apparently you are producing stannous tin at the anode faster than you oxidize it with the hydrogen peroxide. If the bath analysis is correct, say 12 oz/gal sodium stannate, 1 oz/gal caustic soda, and 2 oz/gal sodium acetate for a still tank solution and the bath temperature is kept at 160–170° F, your trouble is probably with too low an anode current density, i. e., too little current or too large an anode area is used. These should be balanced so that a greenish-yellow film is maintained on the anodes at all times. You may have to run with a somewhat higher-than-normal current to produce this film, but can reduce it somewhat afterwards. Some claim that sodium perborate is more stable in this bath than hydrogen peroxide.—K. G. Soderberg.

Q. 74. What method can be used to remove copper from a chromium plating solution? I am under the impression that it can be done by adding some chemical.

A. A method has been described in an article by R. L. Costa, "Regeneration of Chromic Acid Solutions by Cation Exchange", published on page 308 of the February, 1950 issue of Industrial and Engineering Chemistry. Although it requires that the chromic acid plating solution be diluted to contain only 100 g/l (13.3 oz/gal), it may still be applicable with subsequent concentration by evaporation.

Copper, iron, or aluminum are removed from the dilute solution by cation exchange on Amberlite IR-120, manufactured by The Resinous Products & Chemical Company, 222 W. Washington Square, Philadelphia, Pa. In Costa's experiments the exchange resin was regenerated and reused for 100 cycles without apparent damage.

While Costa speaks only about plating solutions, the method should also be applicable to removal of aluminum from chromic acid anodizing solutions or of copper from chromic acid copper-stripping solutions, either by bulk treatment or, if the volume is large enough and the chromic acid concentration sufficiently low, by continuous treatment.—Louis Weisberg.

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Book Review

DR. HAROLD J. READ

Associate Professor of Metallurgy, Pennsylvania State College

LIVING MATHEMATICS by R. S. Underwood and F. W. Sparks, 2nd Edition, 1949, x + 374 pages. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 18, N. Y. Price, $4.00.

There are some folk who like their medicine in the form of sugar-coated pills, and there are others who feel that they are not being properly dosed unless the medication is strong, nasty, and hard to take. The text on elementary mathematics under review is for people of the first class, for the authors have done everything in their power to make their dose of algebra, trigonometry, analytical geometry and simple number theory easy to absorb.

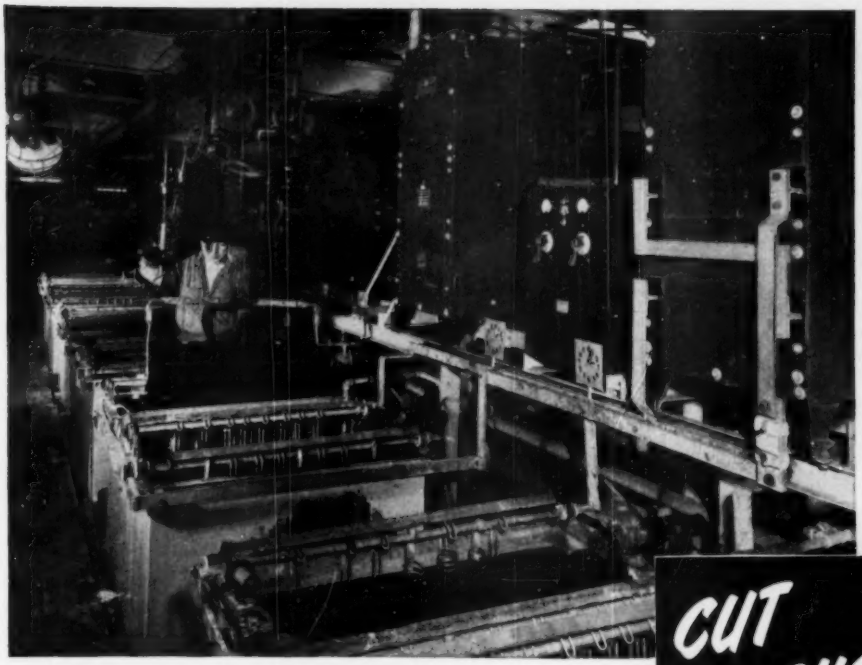
The authors have attempted to provide not only a text on mathematics but also an explanation of how the subject enters into everyday life as well as science. The book is intended to provide material for a one-year college course for those who do not expect to study the subject any further. It will also serve admirably for the purposes of review and self-study.

The scope of the text has already been indicated. Within it the coverage is adequate, and well selected for readers who are interested in what can be done with mathematics rather than in the subject *per se*. A short excursion is also made into the field of calculus, but more to show the practical possibilities of this tool rather than to provide instruction in its detailed manipulations.

As each new topic is introduced, a historical survey of its genesis is presented, and as the subject is developed, its uses are described. There is little doubt that this mode of attack will help in many cases to catch the interest of a student who is taking the course for no other reason than that it is required in his curriculum. There will be some, however, who may join this reviewer in becoming a bit tired of the rather ponderous efforts to preserve a light and frivolous touch throughout the book. One realizes that it is difficult to write lightly about mathematics, but sometimes it is even harder to read what has been written with this object in mind. This is only a minor annoyance and does not detract appreciably from the general excellence of the book.

There are a great many illustrative examples as well as problems and exercises throughout the book. A sufficient number of answers to the problems is included, so that those who use the book for self-study can check the accuracy of their practice work.

An appendix containing enough tables of logarithms, trigonometrical functions, etc., to cover the problems in the text is provided.



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Article Abstracts

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Electrodeposition and Electrowinning of Germanium. Colin G. Fink and Vasant M. Dokras. J. Electrochem. Soc. **95,** 80–97 (February, 1949).
Aqueous, non-aqueous, and fused electrolytes were studied. Deposition from aqueous baths is apparently limited to thin flashes of metal because of the very low overboltage of hydrogen on germanium. Copper, silver, tin, cobalt and nickel were each codeposited with germanium from aqueous solutions. Describes methods in which are used a solution of germanium tetraiodide in ethylene glycol or a fused borax electrolyte in which germanium dioxide is dissolved. Results are tabulated, graphed, and discussed. 45 ref.

Oxide Films Formed on Pure Iron in Concentrated Hydrochloric Acid. W. I. Whitton. Nature **163,** 763–764 (May 14, 1949).
It was found that treatment of specimens of enameling iron in hot dilute hydrochloric acid gave fairly reproducible corrosion rates. Treatment in cold concentrated hydrochloric acid reduced the corrosion rate approximately 40 per cent. Reason for this retardation was found to be presence of an oxide film. Possible mechanisms are discussed.

Surface Treatment and Finishing of Light Metals. II. Corrosion and Protection of Aluminum and Its Alloys. S. Wernick and R. Pinner. Sheet Metal Industries **26,** 1289–1296 (June, 1949).
Reviews and corrosion-test procedures are given, and various methods for prevention of corrosion discussed with comparative test data for protective films. 153 ref.

Corrosion of Electroplated Steel in Automotive Applications. H. A. Pray. Soc. Automotive Engrs., Preprint No. 338 (1949), 12 pp.

The Treatment and Properties of Springs. B. Coates. Birmingham Metallurgical Soc. **29,** 21 (March, 1949).
Discusses the above under the following headings: types of springs; materials used; physical properties; heat treatment; surface finish; and special coatings and finishes. Includes tables, graphs, and diagrams.

Spectral Analysis of Metallic Coatings. K. I. Taganov. Zavodskaya Laboratoriya **15,** 695–700 (June, 1949).
Describes simple method for the above and for spectroscopic determination of coating thicknesses. Typical results are presented.

Oriented Arrangements of Thin Aluminum Films Formed on Ionic Substrates. T. N. Rhodin. Amer. Inst. Mech. Engrs.
The structures of thin aluminum films (10^3 Å) were studied to determine the periodicity and magnitude of the forces on an ionic substrate that promote perferred orientation of the metal atoms deposited on its surface. The films were formed by carefully controlled evaporation in vacuum on freshly cleaved oriented surfaces of alkali halides, mica, calcite, fluorite, zinc blende, and sodalite. The orientation of the aluminum films was strongly influenced by the nature, geometry, and temperature of the substrate and could be semiquantitatively correlated with a binding energy characteristic of the substrate. The characteristics of the film structures show this method to be effective for the preparation of oxide-free oriented metal surfaces for studying surface reaction.

Electroplating on Aluminum for Aircraft Components. E. E. Halls. Ind. Finishing **2,** 30–32, 34–39 (1949); C. A. **43,** 7833 (October 25, 1949).
Operations for the preparation of the aluminum parts for electrodeposition include (1) solvent clean, (2) alkaline etch, (3) acid pickle, (4) a second acid treatment, (5) zincate treatment, (6) copper plating, (7) silver plating, and (8) drying off, with a water rinse between each stage. Details are given.

Hard Chromium Plating on Aluminum and Its Alloys. K. Gebauer. Arch. Metallkunde **2,** 172–178 (1948); C. A. **43,** 7833 (October 25, 1949).
Direct plating on aluminum or aluminum alloys without the use of intermediate layers can be accomplished by roughening the surface. Since the chromium adheres mainly by mechanical interlocking, complete absence of oxide films is not essential. The method consists in dipping the article into a hot 10 per cent caustic solution. A dark film of the heavy metals which are present in the alloy is formed on the surface. The pickling solution contains nickel chloride. The high potential between the finely divided heavy metals and the basis material results in a uniformly rough surface. The adhesion is so good that, after chromium plating, thin sheets can be bent without spalling. The use of an intermediate layer is also possible. In this case, the article is pickled in an alkaline bath containing zinc and iron. A dull gray film is formed, which is removed by rinsing in sulfuric or nitric acid. This pickling treatment may be repeated if additional roughening is desired. A thin copper coating is applied by the conventional cyanide bath. Chromium is plated immediately over this copper film which may be so thin that it cannot be detected under the microscope.
Purpose of the study was to determine relative usefulness of composite Cu-Ni-Cr deposits as protective and decorative coatings on high-carbon steel in various typical atmospheres. Results are tabulated and charted.

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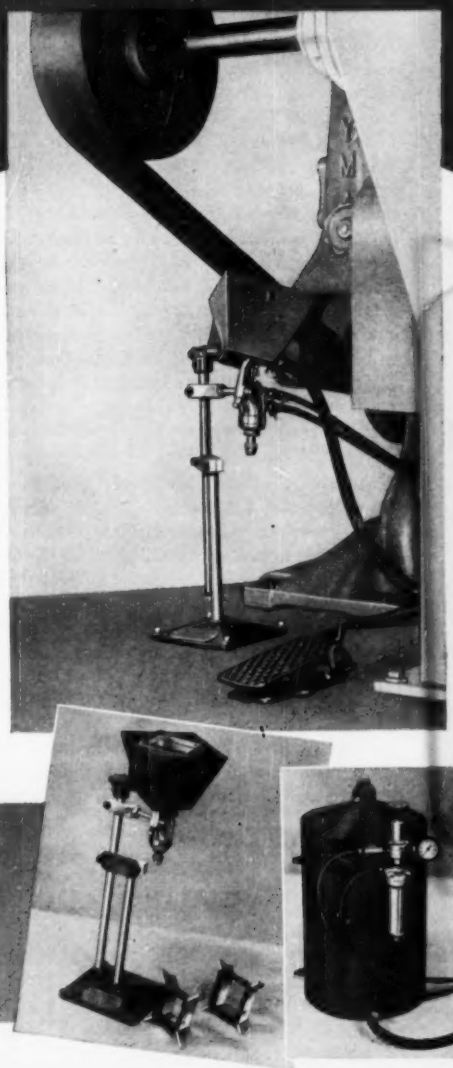

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Article Abstracts

Anodic Treatment of Aluminum Alloys. Jaime Estruch. Electroplating **3,** 123–125 (December, 1949). This is an abridged translation of a paper which was read early in 1949 before the International Automobile Congress in Turin, Italy. Three stages in the evolution of a universal electrolyte are described: (1) modifications of known electrolytes for the treatment of specific alloys and (2) development of a phosphoric-sulfuric acid electrolyte containing phthalates or phenolates. The latter is capable of performing satisfactorily the actual anodic treatment of all alloys containing not more than 30 per cent of other constituents, but the dyed anodic film is still imperfect due, it is believed, to reactions taking place in the cleaning, pickling, brightening, and neutralizing operations. Finally, (3) an electrolyte was developed which simultaneously cleans, pickles and brightens when the article is made the cathode and anodizes when the current is reversed—in other words, a one-bath process which is applicable to all aluminum-base alloys. It is understood that patent protection is being applied for the invention, and in consequence the paper is not as detailed as could be desired.

Protective Coatings for Steel. Am. Machinist **93,** 143 (September 8, 1949).
A solid solution of aluminum and iron, in which the outer layer is rich in aluminum and the inner layer rich in iron, has been developed to protect steel from oxidation and scaling at elevated temperatures. The treatment is (1) pack articles in drum in a mixture of powdered aluminum, aluminum oxide and ammonium chloride (1–5 per cent); (2) rotate drum slowly while heating and maintain within it a reducing atmosphere, usually of hydrogen.
The aluminum content may vary from 5 to 50 per cent according to the service to which the treated piece is to be put. Calorizing temperatures of 1562–1742° F (850–950° C) are recommended for iron and steel, and 392–1472° F (200–800° C) for copper and brass. The purpose of the alumina is to prevent coalescense of aluminum particles as the temperature used is above the melting point of aluminum. The aluminum and the chloride must be renewed from time to time as the mixture is used.
Oil refining equipment, valves, retorts, condenser parts, stokers, roasters, rotary kilns, carburizing and heat-treating boxes, pyrometer protection tubes and burner nozzles may be calorized advantageously.

Application of Dyestuffs to Anodized Aluminum. V. F. Henley. Light Metals **12,** 536–542 (October, 1949).

This paper deals with the coloring of anodic films with organic dyestuffs. Some consideration is given to pretreatment and to sealing treatments. Special attention is given to methods for producing multicolored finishes. Patents and technical literature are included in the review.

Anodic Oxide Coating Formation on Aluminum Alloys. W. N. Bradshaw and S. G. Clarke. J. Electrodepositors' Tech. Soc. **24,** 147–170 (1949).
Anodizing current efficiencies in 20 volume per cent sulfuric acid varied from 28 per cent for 10 per cent copper alloys to 66 per cent for 7 per cent magnesium alloys and were higher at higher voltages and lower at higher temperatures. Coating weights of 2–8 g/sq.ft were obtained by varying the voltage from 8 to 15 and the temperature from 16 to 24° C. Film density was 2.4 g/cm³ for unsealed and 2.5 for hot-water-sealed films. Some vertical porosity was observed by micro technique. A tensile stress in anodized aluminum of 800 psi was changed to a compressive stress of 3,200 psi by hot-water sealing. Current efficiencies for various anode processes are estimated. Anodizing current efficiencies in 3 per cent CrO_3 varied from 1 per cent for 10 per cent copper alloys to 17 per cent for pure aluminum.

Spectrochemical Analysis of Impurities in Metals and Solutions, with Special Reference to Tests Required in Metal Plating Plants. H. Moritz. Metalloberflache **2,** 237–245, 262–268 (1948).
Discusses the principles of spectrochemical analysis and describes the design and operation of the instruments required. Analytical methods are demonstrated by several specific examples. Instruments are illustrated, and test results are graphed and tabulated. 23 ref.

Increasing the Adhesion of Nickel and Hard Chromium Deposits and the Fatigue Strength of Nickel and Chromium Plated Parts by Heat Treatment. K. Wellinger and E. Keil. Metalloberflache **2,** 233–236 (November, 1949).

Graphed and tabulated data show good results by above treatment. Results are evaluated, and photographs show the type of bars used for testing.

3/1/50

Dear Bill:
Wrote Joe Kushner, Stroudsburg 230, Pa., about ELECTROPLATING KNOW HOW today. Thanks. Mac, the 3rd shift super at Kenniston's, tells me E.K.H. has gotten him off the hook so many times, the big brass thinks he's a magician. Not bad, eh? Mac's got cobwebs on his wallet so if he paid the tuition and says, "It's money well spent," E.K.H. must be good!

Sincerely,
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Hard Chromium Deposits of Maximum Wear Resistance. Walter Eilender, Heinz Arend, and Eugen Schmidtmann. Metalloberflache **3**, 57–59 (March, 1949).
Optimum hardness and thickness of plating with respect to wear resistance were determined. Results are graphed.

A Method for Study and Regulation of the Electropolishing of Metals. I. Epelboim, C. Chalin, and B. Galperin. Rev. metallurgie **46**, 151–154 (March, 1949).
Describes electronic apparatus for recording the current-voltage curve during electropolishing. Indicates possibility of application to process control. 14 ref.

Production of Reflecting Deposits by Chemical Reactions. Heinz Pick. Z. Physik **126**, 12–19 (April 4, 1949).
Describes methods and explains the basic principles of production of mirror-like deposits by chemical means. Illustrated. 10 ref.

Polarography of Copper Complexes. I. Ethylenediamine, Propylenediamine, Diethylenetriamine and Glycine Complexes. H. A. Laitinen et al. J. Chem. Soc. **71**, 1550–1552 (May, 1949).
12 references.

Jet-Test for Determining the Thickness of Lead Coatings. R. A. F. Hammond. Electrodepositors' Tech. Soc. **23**, 113–120 (1947–1948).
Preparation and standardization of a reagent suitable for the above is described. A calibration curve and chart showing effect of temperature upon rate of penetration is given together with data concerning the stability of the reagent during storage.

Observations on Heat Consumption of Cooking Utensils. Hans J. Karmaus. Metalloberflache A **3**, 111–114 (May, 1949).
A study of the thermal efficiency of cooking utensils made of different materials and with different internal and external surface treatments. Data are tabulated.

Report of Committee B-8 on Electrodeposited Metallic Coatings. American Society for Testing Materials, Preprint 15 (1949), 30 pp.
Consists of minor and major proposals for changes in specifications and tests, as well as research reports on atmospheric exposure of electroplated lead coatings on steel and copper-nickel-chromium deposits on high-carbon steel. Also includes proposed method for preparation of high-carbon steel for electroplating.

The Weathering Resistance of Cold-Phosphated Steel. G. Schikorr. Arch. Metallkunde **3**, 82–83 (February, 1949).
The effect of cold phosphating and subsequent treatment with oil or oil emulsion on the resistance of steel

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to sea-water spray and to atmospheric conditions was investigated.

Applications of the Radioactive Tracer Technique to Metal Cleaning. J. C. Harris, R. E. Kamp, and W. H. Yanko. A.S.T.M. Bulletin 49–52 (May, 1949).

Gives details of new procedure. Carbon 14 was incorporated by chemical synthesis in N, N-di-n-butyl stearamide. The latter was dissolved in SAE 60 oil, which was applied as a coating to sample pans made of surface-hardened sheet steel and stainless steel. G. M. counts after each of a series of standardized detergent washes are tabulated. The method is more sensitive than existing methods and is quantative in character.

Continuous Steel Strip Pickling. R. W. Treasure. J. Iron & Steel Inst. **162,** 201–212 (June, 1949).

Describes general principles of construction and operation of the modern continuous strip-pickle line. History of its development is outlined, and results of investigation of the removal of mill scale by use of sulfuric acid are given. Also describes electrolytic pickling and refers to the semi-continuous type of pickler and the rotary-coil pickle line. Processing of stainless steel with the aid of caustic soda is dealt with.

Coloring of Metals. N. Bruce Bagger. Materials & Methods **29,** 67–82 (June, 1949).

Manual consists of introduction plus sections dealing with iron and steel, copper and its alloys, cadmium and zinc, aluminum, magnesium, and the final finishing operation. Typical methods are collected in tabular form.

Surface Oxidation, A New Treatment for Iron Surfaces Prior to Lacquering. H. Ketterl. Metalloberflache **3,** 72–73 (March, 1949).

Proposes a new method in which suitable pickling and rinsing, followed by dehydration, will result in production of an oxide that forms an excellent base for lacquer and other protective coatings.

Pickling, Etching, Pretreating, Rust Removal, and Rust Preventives III and IV. (Concluded.) Richard Springer. Metalloberflache **2,** 224–229 (October, 1948); **3A,** 96–99 (April, 1949).

Two more installments of literature and patent review covering 1935–1943.

The Estimation of Small Amounts of Zinc and Cadmium in Nickel Baths. K. Gardner, Electroplating and Metal Finishing **2,** 303–306 (May, 1949).

Describes shortened method for the polarographic determination of the above.

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The Theory of the Deposition of Chromium from Aqueous Chromic Acid Solutions. Erich Muller. Arch. Metallkunde **2**, 110–120 (October 7, 1948).
An extensive theoretical discussion. Diagrams and graphs.

Effect of High-Frequency Alternating Currents on the Electrolytic Deposition of Chromium. R. Bilfinger. Arch. Metallkunde **2**, 131–135 (October 7, 1948).
Experiments show no desirable effect. The effects of superimposed high-frequency ac on current output in the electrodeposition of nickel from a commercial nickel plating bath and of copper from a cyanide bath were also determined.

The Purification of Plating Solutions. II. Nickel Solutions. G. T. Colegate. Electroplating and Metal Finishing **2**, 307–315 (May, 1949).
Outlines various methods for removal of metallic and organic impurities from the above and discusses suitability of each. (To be concluded.)

Belgian Method of Copperplate Protection for Mirrors Explained by Specialist in Process. Alexis Preat. Glass Digest **28**, 18, 26 (May, 1949).
Outlines process now in commercial production in Belgium, in which the silver-mirror deposit is plated with copper.

Improved High-Speed Roller Bearings. Donald F. Wilcock and Frederick C. Jones. Lubrication Eng. **5**, 129–133 (June, 1949).
Examination of bearings removed from turbine engines revealed that the principal source of difficulty is in the brass-roller separator or retainer. Describes laboratory test stand developed for study of full-size bearings under operating conditions. Results of test program are described and summarized. They include effect of lubricant composition; effect of oxide coating of steel parts on transfer of brass to these parts; effects of other metals and electroplates on separator operation and life (silver plating found best); and effects of design modifications.

Uses of the Cathode Ray Oscillograph in the Measurement of Metal Areas and the Kinetics of Electrode Reactions. At. T. Hutcheon and C. A. Winkler. Canadian Research **27**, B, 353–360 (April, 1949).
The instrument described was developed to obtain information on the change in surface area during cadmium deposition in order to find "true current density"-polarization relations. 10 ref.

Plating Magnetic Cobalt-Nickel Alloys on Wire. Iron Age **163**, 49 (June 9, 1949).
Describes process used by Brush Development Company for electroplating silicon-bronze wire with 80 per cent nickel-cobalt alloy. Illustrated.

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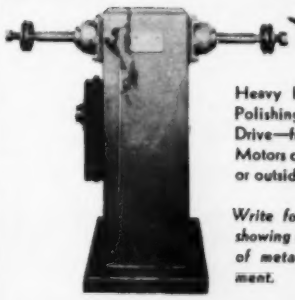

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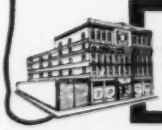

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Patent Abstracts

GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,493,092, January 3, 1950—Method of Electrodepositing Copper and Baths Therefor—Jesse E. Slareck, assignor to United Chromium, Inc.

The baths hereinafter described are stable at higher temperatures, up to the boiling point of solution. No poisonous fumes are evolved.

Air agitation is generally used because it is simple, convenient, and causes no buildup of carbonates in this bath.

Operating current densities of 100 amperes per square foot or more may be obtained. The operating voltage between anode (soluble) and cathode is usually between 2 and 3 volts when bright-plating current densities are used.

Bath composition for ordinary tank plating

		Optimum range
Cu, g/l	30	24–36
P_2O_7, g/l	200	150–250
Citrate radical, g/l	15	5–25
NO_3, g/l	10	5–20
NH_3, g/l	1.5	1–3
*p*H	8.5	8.0–9.5
Temperature, ° F	135	120–150

Bath composition for maximum plating speeds

		Optimum range
Cu, g/l	35	33–38
P_2O_7, g/l	230	190–250
Citrate radical, g/l	15	5–25
NO_3, g/l	10	5–20
NH_3, g/l	1.5	1–2
*p*H	8.5	8.0–9.5
Temperature, ° F	140	130–150

CLAIM 1. A method of depositing dense and adherent copper, consisting in passing electric current from an anode to a cathode-object immersed in an aqueous bath having a *p*H between 7.5 and 9.5 and a temperature between 70° F and 160° F, and in which the bath consists essentially of 7.5 to 45 g/l bivalent copper, 100 to 250 g/l pyrophosphate (P_2O_7), 5 to 20 g/l nitrate (NO_3) and 1–3 g/l ammonia (NH_3).

2 claims.

References cited: U. S. Patents 2,250,556; 2,437,865. Bureau of Standards, Circular No. 52 (June 28, 1916), p. 19.

No. 2,494,205, January 10, 1950—Nickel Plating—R. H. Rogge and E. J. Roehl, assignors to The International Nickel Company, Inc.

We have discovered a process for electrodepositing nickel directly on foundation metals, particularly zinc-base-metal compositions, i. e., zinc and zinc alloys, whereby a thick, ductile and adherent nickel plating substantially without streaks is obtained over a wide range of current density without burning and streaking of the deposit and without necessity for using intermediate ductile coatings such as copper. In our novel and improved process, an easily controllable electroplating bath having a simple composition is employed under plating conditions, including hydrogen-ion concentration and current density, which are properly correlated with the bath composition.

Moreover, by employing the process embodying the present invention ductile nickel electrodeposits exceeding 0.001 inch can be obtained directly on suitable foundation metals particularly zinc-base compositions.

CLAIM 2. A process for electrodepositing nickel directly on zinc-base-metal cathodes which comprises establishing a bath, having a temperature of about 100° F and a *p*H of about 5.3 and containing tartaric acid concentration of about 30 grams per liter, nickel ions and chloride ions in amounts equivalent to a nickel chloride concentration of about 20 grams per liter, ammonium ions equivalent to the amount of ammonium hydroxide required to regulate the *p*H of said bath to about *p*H 5.3, and the balance of the bath being essentially water, said bath being devoid of sulfate ion, and electrodepositing nickel from said bath at a current density of from 10 to about 90 amperes per square foot upon a zinc-base cathode, whereby a thick, ductile and adherent nickel plating substantially free from streaks is obtained.

3 claims.

References cited: U. S. Patents 2,069,566; 2,351,966. "Principles of Electroplating and Electroforming" by Blum & Hogaboom (1930), pp. 241, 242, 243, 248. Metal Finishing, June, 1940, p. 315. Metal Industry, July 7, 1944, pp. 10, 11. Trans. Electrochem. Soc. **23**, 131, 132 (1913); **30**, 127 (1916); **46**, 115, 119 (1924); **80**, 549, 550 (1941).

No. 2,495,668, January 24, 1950—Electrodeposition of Copper—K. S. Willson and D. G. Ellis, assignors to The Harshaw Chemical Company.

EXAMPLE I

CuCN, g/l	30
Free cyanide, g/l	12
B-mercapto ethanol, g/l	4
Water	remainder
*p*H	8.5
C. D. (continuous current), asf	30
Temperature, ° F	140

EXAMPLE II

Dithiodiglycol, g/l	0.6

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EXAMPLE III

B, B'-dihydroxyethyl sulfide, g/l	70
C. D. (interrupted current, 30 sec. on, 10 sec. off), asf	15

EXAMPLE IV

Thioglycollic acid, g/l	20

CLAIM 1. An aqueous alkaline electroplating bath which comprises an aqueous medium to which has been added a metal-ion-yielding material essentially consisting of copper cyanide in concentration from 30 to 150 grams per liter, a sufficient amount of sodium cyanide to produce from 2 to 12 grams per liter of free cyanide in the solution and an amount of a brighten, ing agent of the class consisting of B-mercapto ethanol-dithiodiglycol, B,B'-dihydroxyethyl sulfide and thioglycollic acid sufficient to permit a brilliant cathode deposit of copper upon the passage of an electric current from a copper anode to a cathode through the bath, the concentration of said brightening addition agent being from 0.05 gram per liter to 10 grams per liter in the case of B-mercapto ethanol, from 0.04 gram per liter to 1.8 grams per liter in the case of dithiodiglycol, from 0.007 gram per liter to 35 grams per liter in the case of thioglycollic acid, and from 1 gram per liter to 240 grams per liter in the case of B,-B'-dihydroxyethyl sulfide.

5 claims, 4 examples.

References cited: U. S. Patents 2,147,415; 2,195,409; 2,402,640; 2,410,844; 2,424,887. Metal Industry, March, 1943, pp. 134–137 and April 1, 1943, p. 206.

No. 2,495,941, January 31, 1950—Electroplating Copper on Aluminum—L. F. Mondolfor, assignor to Reynolds Metal Company.

The main advantages of the methods are:

1. Very good adhesion of the copper to the aluminum.

2. No expensive or careful preparation of the surface is required before the article is immersed in the bath. If the article is fairly clean, no pretreatment at all is required; if it is very dirty or very greasy, it is better to remove the dirt or grease to minimize undue contamination of the electrolyte, but it is not absolutely necessary.

3. The article is handled only when it is immersed in the bath and when it is taken out. No careful handling is required.

4. Only one solution is used so that only one tank is required.

5. The solution to be used for preparing the surface and for plating is cheap and relatively harmless and can be used over and over again.

6. The concentration of solution, current density, time, temperature, and voltage are not critical. Relatively wide variations can be tolerated.

In the following example a sheet of 3S alloy of 0.010 gauge was plated in the H temper.

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	Direct Current	
	Anodizing	*Plating*
Tank voltage, volt	25	6
Current density, asf	12	15
Time, minutes	15	15
Temperature, ° F	100	100

The solution used contained approximately 20 per cent copper sulfate and 2 per cent sulfuric acid.

After plating, the sample was annealed at 650–750° F for 10 minutes, pickled to remove the scale, buffed, and then Ericksen cups were drawn until the sheet fractured, without any peeling or cracking taking place on the plating.

CLAIM 2. The method of electroplating copper on aluminum which comprises immersing an aluminum article in a water solution of sulfuric acid and copper sulfate, using the article as the anode and a body of copper as a cathode, applying direct current and forming an anodic coating on the article, reversing the flow of current making the article cathode and the copper body an anode and depositing copper on the article, whereby a firm deposit of copper of any desired thickness may be applied to the article.

CLAIM 3. The method of electroplating copper on aluminum which comprises immersing at least two aluminum articles in a water solution of sulfuric acid and copper sulfate, applying alternating current to the two articles as electrodes forming an anodic coating thereon, discontinuing the use of alternating current, connecting the articles in parallel as cathodes and an anode to a source of direct current and depositing copper on the articles.

5 claims.

References cited: U. S. Patents 1,457,149; 1,534,709; 1,735,509; 1,933,301; 1,947,891; 2,196,016. British Patents 290,903; 484,492. Chem. Abs. **29,** 2459 (1935).

No. 2,497,036, February 7, 1950—N. H. Simpson and P. R. Cutler, assignors to Consolidated Vultee Aircraft Corporation.

The articles of magnesium or magnesium alloys are immersed in an electrolyte in a suitable anodizing tank. The preferred electrolyte for carrying out the invention consists of an aqueous solution which comprises the following ingredients:

Sodium hydroxide	21–25% by weight
Phenol	0.09–0.15% by weight
Sodium silicate	2–3% by volume
Temperature	165–195° F

Direct current, approximately 4 amperes per sq.ft, is passed through the electrolyte with the articles forming the cathode for about 5 minutes, which electrolytically cleans the surface.

Next, alternating current, preferably 60 cycles and 15 to 25 amperes per sq.ft., is passed through the electrolyte for a period ranging from 25 to 35 minutes.

This anodizing treatment will produce an anodic coating comprising about 67 per cent of magnesium hydroxides, about 6 to 8 per cent magnesium silicates,

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about 2 to 3 per cent magnesium organic compounds (magnesium phenolate), and about 20 to 22 per cent of moisture or water of crystallization.

CLAIM 6. That improvement in forming a protective anodic coating on magnesium and magnesium-base alloys which comprises electrolytically treating them in an aqueous electrolytic bath containing sodium silicate and sodium hydroxide, the quantity of sodium silicate used being 2–3 per cent by volume and of sodium hydroxide being 21–25 per cent by weight, said bath also containing an additive of substantially 0.05–10.00 per cent by weight of hydroxy organic compound taken from the group which consists of glycerol, dextrose, cresol, phenol and phenolsulfonic acid, which forms polar groups and retards the formation of gases to effect substantially uniform oxidation on the surface of the metal being coated to produce a uniform coating, said additive becoming a part of the coating formed.

6 claims.

References cited: U. S. Patents 1,749,713; 1,923,502; 2,196,161; 2,203,670; 2,346,658; 2,364,964. Appl. Ser. No. 268,694, Berthier (A. P. C.) published June 8, 1943. British Patents 387,437; 491,025; 522,382; 543,726. Trans. Electrochem. Soc. 81, 353 (1942).

No. 2,497,591, February 14, 1950—Method of Minimizing "Patchiness" in Etched Chromium Electrodeposits—George Dubpernell, assignor to United Chromium, Incorporated.

CLAIM. A method of minimizing patchiness in porous chromium consisting essentially of electroplating chromium predisposed to the formation of porous chromium in a plating bath having CrO_3/SO_4 ratios of from 25 to 1 to 150 to 1 at temperatures of about 77–160° F and current densities from ¼–16 amperes per square inch, appropriate to the temperature of the bath, and etching said chromium electrodeposits to form porous chromium, characterized by continuing the passage of the current in the plating bath in the end part of the plating period, to the chromium already deposited, at a reduced cathodic current density corresponding to a plating current efficiency of 6–0 per cent for 1–10 minutes.

References cited: U. S. Patent 2,182,244. British Patent 335,161. Thompson, "Theoretical and Applied Electrochemistry" (1925), pp. 124–125.

No. 2,497,806, February 14, 1950—Electrodeposition of Cadmium—Louis Weisberg, assignor to Lea Manufacturing Company.

CLAIM 1. A bath for plating bright cadmium consisting of an aqueous cadmium cyanide solution containing alkali metal cyanide and a water extract of roasted coffee containing substantially all of the nonvolatile, water-soluble constituents of roasted coffee, said extract being in amount sufficient to impart a bright surface to cadmium deposited from the bath.

CLAIM 5. A dry composition for the preparation of baths for plating bright cadmium containing, in parts

by weight, cadmium oxide from 26–30 parts, sodium cyanide from 109–125 parts, sodium carbonate from 14–14.5 parts and a water extract of roasted coffee containing all the nonvolatile, water-soluble constituents of roasted coffee from 0.5–1 part.

References cited: U. S. Patents 1,692,240; 1,891,383; 1,932,769; 2,085,750; 2,223,973. Trans. Electrochem. Soc. **63**, 93, 94, 96 (1933); **67**, 326,327 (1935). "The Dispensatory of the U. S. of America", 23 ed.(1943), p. 1931. "Electrolysis of Zinc Sulfate Solutions at High Current Densities", a thesis by Graydon E. Holdeman, January, 1936, at Purdue University, p. 27.

No. 2,497,894, February 21, 1950—Method of Electroplating Fine Wire of Low Elastic Limit—Clare Luke assignor to National Standard Company.

CLAIM 5. The method of electroplating wire of extremely small cross-sectional area and low elastic limit which comprises passing the wire progressively, at a speed of at least several hundred feet per minute while maintained in a substantially catenary suspension of a depth not substantially exceeding one inch and free from contact with any solid object, through a series of baths, at least one of said baths being an aqueous plating electrolyte and the remainder of said baths being cleaning baths and said baths having overflow portions with the meniscuses thereof within the catenary, to a driven take-up, supplying electric current to said wire during such passage by means of connections including only said baths and said take-up, collecting the overflow from each bath in a sump and returning it to the bath, removing liquid carried by the wire from each bath by means of a blast of air directed upon the wire to its appropriate sump, and collecting the wire upon the take-up.

6 claims, 7 figures.

References cited: U. S. Patents 1,068,411; 1,068,412; 1,117,240; 1,210,663; 1,513,696; 2,075,332; 2,093,238; 2,370,973. Metal Industry, Jan. 21, 1944, pp. 43, 44.

No. 2,498,128, February 21, 1950—Apparatus for Electroplating Workpieces—Mathew Lang, assignor to Frederick B. Stevens, Inc.

CLAIM 1. In an electroplating apparatus an electrolyte-holding tank; a horizontal member resting on edges of said tank; a frame carried by said member; downwardly extending legs carried by said frame; a workpiece container rotatable between said legs; a horizontal countershaft journaled in said frame and means supporting said container from said shaft; a drive shaft on said tank in alignment with said countershaft but spaced therefrom; clutch means carried by said shafts and yieldingly urged into driving engagement; lifting means associated with said frame for lifting the same together with said container from said tank; and means responsive to the exertion of lifting-force disengaging said clutch members.

6 claims, 12 figures.

References cited: U. S. Patents 639,766; 1,095,328; 1,207,283; 1,310,662; 1,541,454; 1,848,391; 1,916,465; 2,035,633; 2,249,609.

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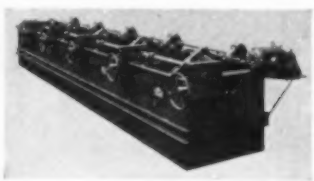
Equipment and Supplies

E—436. Dust Collector—The Hisey-Wolf Machine Company, Division of the Cincinnati Electrical Tool Company, Cincinnati 8, Ohio, now markets a line of dust collectors through which air from polishing or grinding lathes is exhausted inside the building. In them heavy particles are

directed downward by a baffle plate directly into a large tray. The dust- and grit-laden air is said to be thoroughly filtered through closely woven fabric and steel-wool filter bags. A foot lever serves to shake the contents of the bags into the readily removable tray. For further information, use Reader Service Card.

E—437. Barrel Plating Machine—Daniels Plating Barrel and Supply Company, 129 Oliver Street, Newark 5, N. J., has introduced a 5-cylinder plating barrel unit having a common steel tank and single motor drive. Heretofore the company's largest unit with a common tank consisted of two cylinders. Now a newly designed ratio lift affords an infinite number of cylinders in a common tank of double-welded steel construction, with or without rubber lining, as pictured here.

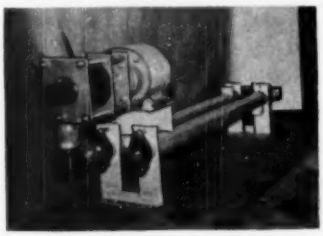


The cylinders may be constructed of heavy reinforced bakelite, molded hard rubber, or high-temperature lucite. The Daniels contact design, that is said to have proved successful in thousands of production jobs, is employed and hence many parts may be plated at high current densities in a short plating time and with high throw. The machines can be fitted with two flanged overflows for maintenance of solution level and with flanged fittings for continuous-filtering lines. Ease in handling work and low maintenance cost are among advantages claimed. For further information, use Reader Service Card.

E—438. Coating Thickness Gage—A new special-purpose Magne-Gage for measuring the thickness of nickel coatings on iron or steel in the range of 0.001–0.0045 inch, by magnetic means without injuring the coating or base metal, is announced by the American Instrument Company, Inc., Silver Spring, Md.

This thickness range is beyond that of the standard Magne-Gage (which measures thickness of nickel coatings on iron or steel from 0 to 0.002 inch) and cannot be supplied on Magne-Gages having other calibrations. For further information, use Reader Service Card.

E—439. Standardized Karbate Heat Exchangers—Carl Buck & Associates, P. O. Box 267, Essex Falls, N. J., offer a series of Karbate heat exchangers with centrifugal pump of Nu-Kast No. 166, motor, and all internal connections. The heat exchangers make use of one, two, or four tubes of 4½ or 9-ft. lengths. Each 4½ feet is said to heat in 2.5 hours 200

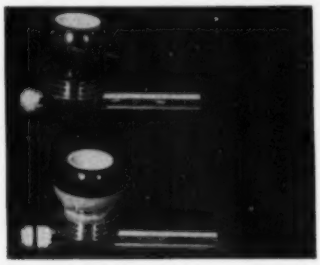


gallons with 10-psi steam and 350 gallons with 45-psi steam, from 60 to 170° F. Solutions come in contact only with nonmetallic materials, resistant to all plating or pickling solutions except those containing nitric or chromic acid. A new mechanical seal of extremely simple construction prevents pump leakage. For further information, use Reader Service Card.

E—440. Finish for Aluminim—Iridite Alcote, a chromate-type corrosion-resistant finish for aluminum has been announced by Allied Research Products, Inc., Baltimore, Md. Like the Iridite finishes for zinc and cadmium, Iridite Alcote is applied by a simple nonelectrolytic dip in a solution operated at room temperature. No fumes are given off during processing, and consequently no exhaust systems are required. The coating ranges in color from clear to light bronze in from 10 seconds to 2 minutes.

Salt spray tests indicate resistance to corrosion for as long as 1000 hours on wrought stock and 250 hours on castings depending upon alloy and treating time. Tests to determine the paint-base characteristics of the coating are said to indicate that Iridite Alcote provides excellent adhesion of the paint to the metal. In addition, the coating is highly resistant to abrasion. Treated parts may be buffed, roughly handled or formed, without materially affecting the coating. For further information, use Reader Service Card.

E—441. Process for Plating on Aluminum—MacDermid, Incorporated, Huntingdon Avenue, Waterbury, Conn., recently announced a chemical process called Alumetex Process, which, accord-



ing to reports, eliminates many of the pitfalls in electroplating on aluminum.

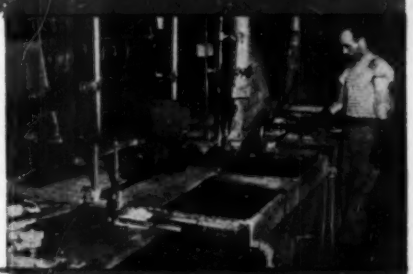
Some of the outstanding features are said to be: (1) one process for all regularly used alloys of aluminum, (2) excellent corrosion resistance and adhesion obtained by simple immersion treatments, (3) complete elimination of blisters, pits and dull deposits, and (4) handling of sand castings, die castings, and wrought aluminum through the same cycle. The process has been tested and proven in production for the past three years, under various conditions, by the Harding Manufacturing Company, one of Detroit's largest job-plating plants. For further information, use Reader Service Card.

E—442. Zinc Brightener—Allied Research Products, Inc., Baltimore, Md., has developed what is claimed to be a radically new type of organic brightener for zinc plating solutions. Called ARP No. 3, this liquid brightener is for use in any type of zinc plating bath. It is said to produce better results at lower cost than established materials now on the market. For further information, use Reader Service Card.

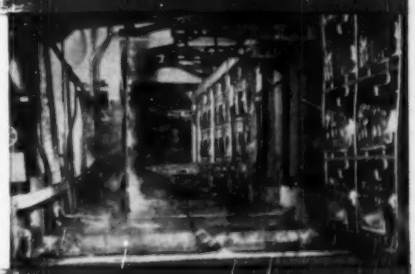
E—443. Anti-Stain Addition for Rinse Tanks—A new product, known as Rins-Aid, for addition to a static rinse tank, is announced by R. O. Hull & Company, Inc., Dept. X2, 1279 W. 3rd Street, Cleveland 13, Ohio. It is said to form a water-repellent film on freshly plated work, leaving the work virtually dry. A concentrated product, Rins-Aid, is added to the water rinse in the amount of about 10 oz/100 gal. Although it may be used in the final rinse, it is preferred to make the addition to the rinse tank just before the last dip.

How Manning, Bowman & Co. gets efficient cleaning prior to nickel and chrome plating

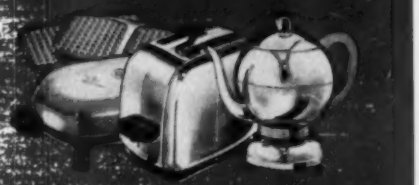
After boiling, percolator base (after dip) Pennsalt Z-54 bath. (Cathodic electrolytic, 4 oz. of cleaner per gal., 6 volts, 20 seconds.) Hand line used for boiler racks.



After wax and grime, work passes second Z-54 bath for reverse cleaning. (Anodic, 4 oz. per gal., 6 volts, 5 to 10 seconds.)



After nickel plating, work enters automatic chrome line. Tops of waffle irons are shown entering Pennsalt cleaner bath.



PENNSALT helps Manning, Bowman produce these brilliant household appliances.

PENNSALT CLEANERS prove superior in rigid comparison tests

Plating on household appliances must not only be bright—for the sake of sales appeal . . . but it must also adhere tightly—to prevent it from peeling under extreme heat and humidity encountered in use. This necessitates efficient cleaning prior to plating. And that's where Pennsalt metal cleaners get a chance to show their worth.

Recently, at the Manning, Bowman & Co. plant in Meriden, Conn., rigid tests were run to determine which cleaner would permit the best plating. The general plating foreman, an expert from 'way back, was after just one thing: *results*.

Various articles, both ferrous and non-ferrous, were sent through two parallel lines. One used Pennsalt® Z-54, the other used competitive cleaners. The tests proved Z-54 definitely superior in actual performance, and more economical per unit cleaned. Z-54 lasted much longer . . . with practically no rejects due to spotting or "color." Now Manning, Bowman is 100% sold on Pennsalt metal cleaners.

ONE BIG REASON why Pennsalt cleaners do such a consistently good job is this: as a *basic* producer, Pennsalt controls the manufacture of its products from raw material to finished form. This controlled manufacture—backed by intensive research—results in higher quality at lower cost to *you*.

Call in your Pennsalt representative. He'll be glad to study your present cleaning method, and possibly show you savings in time and money. Or write to: Special Chemicals Department, Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

PENN SALT

PROGRESSIVE CHEMISTRY FOR A CENTURY

There's a Pennsalt Cleaner for every metal cleaning operation

Equipment and Supplies

The advantages of Rins-Aid are said to be: virtually complete freedom from water staining of chromium, nickel, cadmium or zinc plate; a buffed, improved appearance of the surface; greater ease of drying; and use of a lower temperature than usual in the final hot water rinse. For further information, use Reader Service Card.

E—444. Air Filter—A filter for compressed-air lines recently introduced by the Sparkler Manufacturing Company, Mundelein, Ill., is said to provide a large effective filtering area within a minimum space.

Each horizontal V-shaped filter disc consists of two perforated leaves separated at the center by a perforated flange. These leaves are covered with filter media, such as synthetic-rayon nonwoven cloth, resin-treated filter paper, or woven wire cloth, providing a wide range of porosity and degree of filtration.

The filter housing is high-pressure-cast aluminum, and all contact parts are rust proofed. The filter is made in sizes and capacities to meet every requirement. The entire line is engineered for mass production and will be marketed at a low price. For further information, use Reader Service Card.

E—445. Polishing and Buffing Compositions—A line of Prozite bars and liquids for buffing, Pro-Brite lime finishes, Pro-Lube lubricant stick for polishing wheels and belts, and Prozite emery cake is offered by the Prozite Division, Gerity-Michigan Corporation, Adrian, Mich. Made from a new type of finely divided abrasive, said to present a large number of cutting edges and large abrasive surface per volume, and of new bases and lubricants of highly emulsifying and saponifying character, the new compositions are claimed to provide faster cut and more mileage than the usual compositions and to have high cleanability.

The line is reported complete for buffing nonferrous metals including diecastings, stainless and regular steel, precious metals, plastics, and rubber. For further information, use Reader Service Card.

E—446. Barrel Material and Liner—Lupomatic Industries, 4510 Bullard Avenue, New York 66, N. Y., has announced a new type of material which can be used for making complete barrels or as a lining for tumbling barrels made of other materials. Called Tumb-L-Dur, it is said to have the necessary resilience so essential to tumbling, not to warp, to have the strength of steel, to be readily worked (sawed or drilled), and to be ideally suited for either wet or dry tumbling. In one installation where wood wore out in less than four weeks, Tumb-L-Dur is reported to have been in operation for eighteen months without any signs of wear. For further information, use Reader Service Card.

E—447. Cleaning and Peening Shot—"Five Star" Malleabilized Shot and Grit for general cleaning last three to four times longer and wears equipment 65 per cent less according to the manufacturer, Steelblast Abrasives Company, 6536 Carnegie Avenue, Cleveland 3, Ohio.

"Kut-Steel" Peening Shot is said to have high hardness and tensile strength and is claimed to last 20 to 30 times longer than chilled iron. For further information, use Reader Service Card.

E—448. Lead Lining Alloy—Chromium plating tank linings, anodes, and heating-and-cooling coils made from "Nalco Metal", a new lead alloy manufactured by National Lead Company, 111 Broadway, New York 6, N. Y., are said to be substantially more resistant to the corrosive and pitting action of chromic acid solutions. Anodic treatments of linings and coils made from this new metal are unnecessary, avoiding the usual production interruptions to re-establish a protective coating.

Sheet form of this alloy is cut and formed as easily as conventional lead alloys for linings, and in pipe form it is readily coiled, or looped and bound, clipped or blocked into units of any design or form. For further information, use Reader Service Card.

E—449. Buffing and Polishing Machine—A new buffing and polishing machine has been developed by the Vonnegut Moulder Corporation, Indianapolis, Ind.

The novelty of this design is in the so-called "underslung spindle". This design, the company claims, has a number of advantages, among which are: (1) unusual rigidity of a relatively long, thin spindle, (2) no structural interferences for spacing other bearings to best advantage along the underside of the bearing support or for locating the motor and power-transmitting details, (3) maximum dependability of accurate bearing alignment, as well as strength and rigidity. For additional information, use Reader Service Card.

E—450. Buffing Machine—A buffing machine manufactured by Lewis Roe Manufacturing Company, 1042–1050 De Kalb Avenue, Brooklyn, N. Y., was designed for light buffing and coloring and to take the place of heavier machines for this class of work. The machine is driven by a ¼ hp A-C or D-C motor mounted on the stand below the spindle, is equipped with two self-aligning ball-bearing pillow blocks, and has a ¾-inch diameter spindle, 22 inches long. Longer spindles can be furnished if required. The spindles are turned down at the ends to ½-inch diameter and threaded eight square threads to the inch. The spindle is tapped for taper points which are furnished with machine.

A switch, eight feet of cord, a V-belt and a device for keeping belt at a uniform tension are also furnished. Machine weighs approximately one hundred pounds and can be moved about the shop. Electric current to operate machine costs approximately one cent per hour. For further information, use Reader Service Card.

E—451. Small-Article Dryer—Technic, Inc., 39 Snow Street, Providence, R. I., offers the Technidrier, a dryer which transforms highly polished metal surfaces wet with cold water to sparkling dry in less than two minutes. Features include elimination of rejects due to scratching or

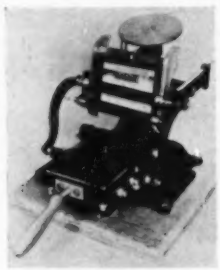
staining, elimination of alcohol and hot-water rinses, ease of putting work in and taking work out, complete visibility of work in process through glass door, and simple installation and operation.

The Technidrier is equipped with adjustable spindles mounted on a turntable, so that work can be removed or put in without disturbing other work being dried. There are ten 14-inch spindles with a clearance of 14 inches, which are adjustable to handle either ten 14 x 14-inch racks or five 14 x 28-inch racks. The dryer operates on a 1–2 psi steam pressure and can accommodate bulk work. The cabinet comes in blue-gray wrinkle, trimmed with stainless steel. For further information, use Reader Service Card.

E—452. Cleaner for Motors and Generators—A cold liquid cleaner for use on electric motors and generators and for general machine maintenance has been developed by the Electrochemicals Department of E. I. duPont de Nemours & Company. During the last year tests under actual service conditions are said to have shown that the compounded products, "Cleaning Mixture No. 49", dissolves grease rapidly, evaporates quickly, and is practically inert to ordinary electrical insulating materials.

Composed of 30 per cent by volume "Blend CC No. 49" and 70 per cent Stoddard Solvent, it has low flammability and mild toxicity. "Blend CC 49" is now available from duPont distributors, many of whom are also prepared to supply the complete mixture.

E—453. Offset Decoration on Plastic, Glass, Metal—A hand-operated offset machine, manufactured by the Apex Machine Manufacturing Corporation, 53 E. 10th Street, New York 3, N. Y., will print



in any color illustrations, decorations, trade marks, trade names or advertising matter on pens, pencils, lipstick tubes, compacts, lighters, and many other items, round, flat, concave, or convex. Using type, cuts, or electros, it will print by the transfer process an area up to 3 x 4½ inches at the rate of 500–800 pieces an hour.

All ink colors are available from the company, in addition to a variety of inks, rollers, type, and special parts for special purposes. For further information, use Reader Service Card.

E—454. Porous Stainless Steel Filters—Low initial cost and ease of operation because of extreme compactness are claimed for the new Surfamax porous stainless-steel filters manufactured by Micro Metallic Corporation, 193 Bradford Street, Brooklyn 7, N. Y. The filter elements are in the form of corrugated assemblies, having the general shape of an accordion. Available in six pore openings ranging from 5 microns (0.0002 inch) to 165 microns (0.0065 inch), these stainless steel filters offer uniform pore sizes, closely limiting the size of the particle which can pass through the filter. Unusually high throughput rates are obtained for liquids and gases because of the high percentage of voids. For simplified servicing, a single nut opens the filter container and the filter element may be removed in a matter of seconds. Units are highly polished for easy cleaning.

Standard units with pipe connections ranging from ¼ to 2 inches are available. Units are supplied on special orders up to 10-inch pipe size and in capacities up to 10,000 gallons per minute. For additional information, use Reader Service Card.

E—455. Nonlubricated Cylindrical Valve—A nonlubricated cylindrical plug industrial-control valve, providing leakproof shutoff while eliminating contamination, has been developed by Belfield Valve Division of Minneapolis-Honeywell Regulator Company.

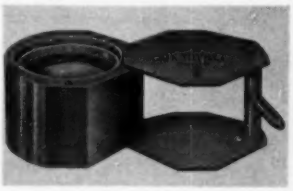
The new design includes a permanent seal at the plug stem, sealing packing at the base of the plug, and a fixed-load spring, combined with a closer dimensional tolerance and micro finish on the plug and body bore. For further information, use Reader Service Card.

E—456. Immersion Heaters and Controls—Pyrosil, Inc., Cuyahoga Falls, Ohio, offers a series of "Hot Rod" immersion heaters of from 1 to 10.5 kw standard capacity and bulb-type indicator-controllers. The heaters are made of fused silica, which is inert to most acids, one of the best electrical insulating materials known, and transparent to the infrared radiation. Special units from 0.35 to 30 kw capacity have been built. For further information, use Reader Service Card.

E—457. Analytical Balance Scoop—The Ohaus Scale Corporation, 10–14 Hobson Street, Newark 8, N. J. announces a new Analytical Balance Scoop and Counterweight, both of aluminum to eliminate

buoyancy errors due to air-density variations. These scoops are available in both 10 and 30 milliliter sizes and have long pouring spouts and handles. Each set is serialized with corresponding numbers for easy identification where more than one set is being used. For further information, use Reader Service Card.

E—458. Pocket Magnifier—Stratex Instrument Company (formerly Mohave Instrument Company), Los Angeles 27, Calif., is now manufacturing an improved 10-power Hastings triplet pocket magnifier for quality control and line inspection. The extreme brilliance and flatness of the color-free field is said to fill the heavy demand for an inexpensive and readily available instrument for visual detection of minute flaws and defects. The three cemented lens elements are



mounted in a hard-finished aluminum cell protected by a nonmagnetic stainless-steel frame. An extra heavy nickel-silver jump ring provides for attachment to watch chain or cord. For further information, use Reader Service Card.

E—459. Water Hardness—A new "Hagan Total Hardness Test", originally developed by Schwarzenbach and his associates in Switzerland and said to be superior to the time-honored but time-consuming old "soap-shaking" method, involves a simple direct titration with a distinct color change at the end point, so that the possibility of error due to subjective judgment is eliminated. Interferences, although seldom found, are easily eliminated. The answer, correct to less than 1 ppm of calcium, is found in one minute.

Where it is desirable to determine hardness due specifically to magnesium, the operator makes the total hardness test and the calcium test, the difference giving him the magnesium value.

All equipment and reagents required for either the Hagan Total Hardness Test or the Hagan Calcium Test is available through Hagan Corporation (parent of Hall Laboratories, Inc.) and its associated firms, Calgon, Inc., and the Buromin Company. For further information, use Reader Service Card.

E—460. Protection of Zinc and Cadmium—Allied Research Products, Inc., Baltimore, Md., announces Iridite No. 8-P, a powdered material for use in the corrosion protection of zinc or cadmium, which is said to achieve appreciable savings in shipping costs and eliminate the need for return packaging. For further information, use Reader Service Card.

E—461. Plating Stopoff—A new plastic material called Maskcoat No. 2 has been introduced by Western Coating Company, Pasadena, Calif. It is said to be suitable for use in chromium, copper, cadmium, nickel and other plating solutions, to have excellent adhesion, and be easily stripped off after plating. For further information, use Reader Service Card.

CHEMCLEAN BREVITIES

Facts Without Frills

DI-PHASE CLEANER (Chemclean No. 133)

A pre-cleaner which removes:

Buffing compounds
Hard, caked-on soils
Oils and greases
Drawing compounds

Often eliminates the degreaser.

Used at room temperature.

Not critical—safe—efficient.

Prevents rust between operations.

Inexpensive: use 1 part No. 133 to 3 to 5 parts water.

That's the Story

Price in 55-gallon drums, 95c per gal.

Send for a trial lot—

5 gals. at $1.50 per gal. Prices f.o.b. plant

CHEMCLEAN PRODUCTS CORP.

Manufacturers of Industrial Cleaners, Strippers and Chemical Specialties

DEPT. P-AP
64 SIXTH AVE.
NEW YORK 13, N. Y.

A. E. S. News

Paper Awards

At the meeting of the Executive Board on February 17 a number of changes and additions were made in the Society's Paper Awards. The amended regulations now call for the following:

1. The Founders' Gold Medal, with an award of $50.00, for the best paper presented at the annual Convention.
2. The A. E. S. Gold Medal, with an award of $50.00, for the best paper printed in PLATING during a fiscal year.
3. The A. E. S. Silver Medal, with an award of $25.00, for the second best paper printed in PLATING during a fiscal year.
4. A Certificate of Honorable Mention, with an award of $15.00, for the third best paper printed in PLATING during a fiscal year.
5. The Mechanical Finishing Award sponsored by the Lea Manufacturing Company and consisting of a certificate and $50.00, for the best paper on mechanical finishing appearing in A. E. S. publications during a fiscal year.
6. The Chromium Plating Award, sponsored by Nutmeg Chrome Corporation and consisting of a certificate and $50.00, for the best paper on chromium plating appearing in A. E. S. publications during a fiscal year.
7. The Gold Plating Award, sponsored by Technique, Inc. Details of this new award will be announced shortly.

This schedule of awards will become effective in time for the Boston Convention.

Back Issues of The Monthly Review

Acknowledgment is made to Mr. F. C. Mesle, Past President of the Society, for a collection of back issues of THE MONTHLY REVIEW, PLATING's predecessor. They were badly needed to complement files in Branch libraries.

Those who have copies which they do not use of THE MONTHLY REVIEW dated before 1944, of PLATING for January-March, 1948, and of the *Proceedings* for 1944 or earlier years will do the Society a service if they will send them Parcel Post collect to the Executive Secretary, Box 168, Jenkintown, Pa.

Certificates Appreciated

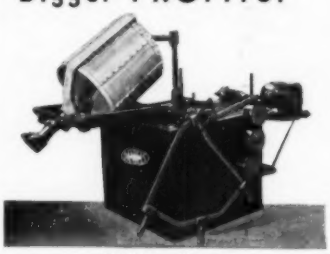
Several past presidents and honorary members of the Society have expressed their appreciation of the certificates sent them through the action of the Executive Board. They include Dr. Hiram S. Lukens, Mr. George B. Hogaboom, Mr. Edward M. Stephenson and Mr. E. T. Candee.

DANIELS

At your Service

—for

Faster Plating
Greater Production
Bigger PROFITS!



This Picture shows the Barrel in an Unloading Position

The Daniels OLS Type Plating Barrel

does more work per day for the modern Electroplating Plant

The ease of loading and unloading a DANIELS Plating Barrel is one of its outstanding features.

There are no overhead devices—no extra construction or pulleys. The counterbalanced sidearm enables the operator to handle work quickly and easily. This means more work per day—furthermore, the solution is not dumped every time the work is put in, which also saves time and labor.

The DANIELS OLS Type Plating Barrel is made in several sizes to fit the customer's needs.

Let us give you more details
Write or 'phone

DANIELS PLATING BARREL & SUPPLY CO.

DANIELS MANUFACTURERS & DISTRIBUTORS Electroplating and Polishing Equipment and Supplies

129 Oliver Street, Newark 5, N. J.
Telephone MArket 3-1762 or MArket 3-6196

A. E. S. 37th ANNUAL CONVENTION

and

4th INTERNATIONAL ELECTRODEPOSITION CONFERENCE

Hotel Statler, Boston, Mass. -:- June 12-15

Technical Program

For the second time the A. E. S. Editorial Board will present an intensely interesting technical program of great practical usefulness. The following tentative program is subject to change.

It centers around some of the most important developments which have taken place in the plating industry during the recent years—developments which have for their object to reduce total cost of plating by reduction in hand labor for finishing prior to plating. Not less than three sessions will be devoted to progress in this field.

General Session

The first session, on Monday afternoon, June 12, will be devoted to papers not related to the symposia subjects.

Among the papers scheduled for this session is one by Dr. J. E. Stareck, H. Mahlstedt and F. Passal of United Chromium, Inc., Detroit, Mich., entitled "*The Self-regulating High Speed Chromium Plating Bath*", a very recent development. Another paper, by Dr. A. Brenner and V. D. Morgan of the National Bureau of Standards, Washington, D. C., is concerned with "*The Nodule Method of Measuring Adhesion of Electrodeposited Coatings*" that offers possibilities for practical application.

Another paper deals with "*Advances in Electrodeposition in the Graphic Arts*" and will be presented by Edward I. Peters of Pontiac Engraving & Electrotype Company, Chicago, Ill., Secretary of the Technical Advisory Committee of the National Association of Electrotypers and Stereotypers, Inc. A *second paper on a related subject* is also expected, and there will be a discussion of the relation between electroplating and the graphic arts. Members of the aforesaid Association are being invited. They will find much of interest also in the later session, especially in the paper by Reinhard.

Finally, there will be a paper by Dr. Richard Springer, Specialwerk für Galvanotechnik, Leipzig, Germany, on "*Strides in German Electroplating, 1940-1950*" which should provide useful data.

Symposium on Levelling

This symposium, which will occupy the morning and afternoon sessions on Tuesday, June 13, will open with a paper on "*Measurement of Surface Smoothness*" by Dr. H. L. Kellner of Lea Manufacturing Company, Waterbury, Conn. In it will be defined the terms used in subsequent papers and will be evaluated methods of measurement.

The next two papers will deal with "*Levelling and Smoothing by Chemical and Electrochemical Polishing*" and "*Levelling with PR Current Plating*" by Dr. C. L. Faust, Battelle Memorial Institute, Columbus, Ohio, and George W. Jernstedt, Westinghouse Electric Corporation, respectively.

The last paper at the morning session will deal with "*Some Observations of the Microthrowing Power of Plating Solutions*" and present the results of a detailed microscopic study of the ability of ordinary plating solutions to plate into base-metal crevices. It has been written by C. E. Reinhard of The New Jersey Zinc Company (of Pa.), Palmerton, Pa.

The two remaining papers of this symposium will be given at the afternoon session. They will present data on the *levelling ability of the cobalt-nickel solutions and of the organic type of "semibright" nickel solutions.* The authors of the first paper are Dr. Louis Weisberg, Consultant, New York City and M. B. Diggin, Hanson-Van Winkle-Munning Company, Matawan, N. J.; the author of the second paper, A. H. Du Rose, The Harshaw Chemical Company, Cleveland, Ohio. The session will conclude with a general discussion of levelling.

Symposium on Mechanical Finishing

Closely allied with progress in chemical and electrochemical levelling is progress in the field of mechanical finishing. Several papers on this subject will be given at the Wednesday morning session, June 14.

The first paper, by Herbert M. Goldman, Enthone, Inc., New Haven, Conn., "*Metal Finishing by Abrasive Tumbling*", presents both a critical review and new information on this old, but continually changing subject. Another paper on a special phase of abrasive tumbling is likely. Other scheduled papers include one on "*Liquid Buffing*" by E. T. Candee of Lea Manufacturing Company, Waterbury, Conn. and one by V. M. Darsey of Parker Rust Proof Company, Detroit, Mich., dealing with the *application of phosphate coatings on metals prior to forming to reduce cost of subsequent finishing.*

A. E. S. Research Session

This year the lead-off paper at the A. E. S. Research Session by G. M. Cole of Ternstedt Division, General Motors Corporation, Detroit, Mich., will deal with "*The Reporting and Use of Research Data*". The second paper, by Dr. W. A. Wesley of The International Nickel Company, Bayonne, N. J., is entitled "*Why Pay for Porosity Research*". Both speakers are members of the Research Committee and Vice-Chairmen of its Research Directing Subcommittee and will tackle one of the platers' most important tasks—how to interpret research results.

The third paper, "*Use of Radioactive Isotypes for Determination of Current Distribution*", by Dr. John Kronsbein of Evansville College, Evansville, Ind., is an up-to-the-minute report, which will show how an ultra-modern tool is applied to a platers' problem.

This, the last technical session, will be held on Thursday morning, June 15.

General Program

Two features should be of special interest to the convention visitor from the West and South: the Boston Pops concert in Symphony Hall on Tuesday night and the Clambake and Outing at Nahant. Both have their particular Boston flavor not found anywhere else.

The regular convention events include the Opening Session on Monday morning at 9:30 A. M., the International Fellowship Club's Open House on Monday night, and the Banquet on Thursday night.

Ladies' Program

A new feature at this convention will be a Ladies' Educational Session which is planned to initiate the ladies in the mysteries of the plating art.

There will also be a sight-seeing tour of Boston and surroundings to acquaint the visitor with this historic city. Of equal interest will be a trip, with tea, to the Gardner Museum, which is filled with rare treasures from all over the world and once was the palatial home of Mrs. John Lowell Gardner. The Traditional Aunt Ella's Party sponsored by Oakite Products, Inc., and the International Fellowship Club's Plato Party (the latter given at the Clambake) are other features.

Electrodepositors' Technical Society Luncheon

Members of the Electrodepositors' Technical Society will attend a luncheon on Tuesday in honor of the Silver Jubilee of that Society. A number of visitors from abroad are expected to grace this affair with their presence.

PAC
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Branch News

Coming Events

DETROIT BRANCH

ANNUAL STAG DAY
Saturday, July 29
at Forest Lake Country Club
near Pontiac, Mich.
Chairman: Walter Pinner
Program: Soon to be announced
Make plans now to attend.

F. J. NEWTON, *Librarian*

INDIANAPOLIS BRANCH

ANNUAL EDUCATIONAL SESSION
AND DINNER DANCE
Saturday, May 6
in Indianapolis Athletic Club

Educational Session

Papers on "Rectifiers vs. Motor Generators", "High Chloride Nickel Baths", and others

Dinner-Dance

Floor Show
Tickets from Robert Bruck, 849 Massachusetts Avenue, Indianapolis, Ind.

D. L. PATRICK,
Publicity Chairman

MILWAUKEE BRANCH

ANNUAL EDUCATIONAL SESSION
AND BANQUET
Saturday, April 27
in Schroeder Hotel

Educational Session at 2:00 P. M.
Symposium on Bright Finishes
Speakers: Mr. C. F. Nixon, Ternstedt Division, General Motors Corporation, Detroit, Mich., "Notes on Buffing and Polishing"
Dr. C. H. Castle, Roto-Finish Company, Kalamazoo, Mich., "Low Cost Finishing with Roto-Finish"
Dr. M. M. Beckwith, The Harshaw Chemical Company, Cleveland, Ohio, "A Buffing Nickel"

Banquet in the Evening
Floor Show—Dancing
All interested in finishing invited.

PHIL J. RITZENTHALER

11TH ANNUAL NEW ENGLAND REGIONAL MEETING

Saturday, May 6
in the Hartford Club, Hartford, Conn.
Educational Session at 2:30 P. M.
Banquet in the Evening
Entertainment—Dancing
Tickets from Stanley Platoz, 26 Erwin Place, New Britain, Conn.

PITTSBURGH BRANCH

ANNUAL BANQUET
Saturday, April 15, 6:30 P. M.
in Sheraton Hotel
Dinner—Entertainment—Dancing
Tickets at $5.00 each from R. H. Schindler, 227 Line Avenue, Elwood City, Pa., *or* J. Davidson, Tola Street, Glenshaw, Pa.

E. J. SMITH, *Secretary*

TORONTO BRANCH

ANNUAL REGIONAL MEETING
Saturday, May 6
in General Brock Hotel, Niagara Falls, Ontario
Technical Session in the afternoon
Speakers: Mr. Ed Rinker, Bart-Messing Corporation, Brooklyn, N. Y., "Cleaners"
Mr. Harold W. Faint, Industrial Filter and Pump Manufacturing Company, Kalamazoo, Mich., "Filtration"
Mr. W. M. Phillips, General Motors Research Laboratories, "Plating on Zinc Base Diecastings"

Dinner-Dance in the Evening
Tickets at registration desk in hotel

R. W. STEPHENS, *Secretary*

ALLENTOWN BRANCH

The regular monthly meeting on February 15 was held at the Nineteenth Street Vocational School in Allentown.

During the short business session it was decided to hold future meetings, until further notice, at Spurgeons Hotel, Allentown. These will be dinner meetings, on the third Wednesday of each month.

A nominating committee consisting of JAMES RIEGEL, G. LARRY MCMICHAEL, JOHN MCCURLY and LOUIS SEISSMAYER was appointed to select nominees for Branch Offices, elections to be held at the April meeting.

MR. ED OTTEN of Philco Corporation, Philadelphia, Pa., gave an interesting talk on "Bright Nickel Plating". An informative round table discussion followed.

JAMES F. RIEGEL,
Secretary-Treasurer

BALTIMORE-WASHINGTON BRANCH

The February meeting was held on the 14th in the Engineers' Club, Baltimore.

After a brief business session, LIBRARIAN WALTER OLSON introduced the speaker, MR. RICHARD O. HULL of R. O. Hull Company, Inc., Cleveland, Ohio, who talked informatively on the subject, "New Ideas in Plating and Control Methods". Mr. Hull covered such items as the application of the Hull Cell test control of cadmium and chromium solutions, the use of the so-called Wood's nickel strike to replace cyanide copper in plants where disposal of cyanide wastes is a problem, and the use of insoluble anodes in cyanide copper plating. He also told a number of anecdotes about unusual plating problems encountered in his consulting practice and their solution. A lively discussion period followed.

VERNON A. LAMB, *Secretary*

BOSTON BRANCH

At the meeting on January 5, LIBRARIAN GLOVER introduced A. E. S. PRESIDENT A. W. LOGOZZO, who discussed and illustrated modern techniques in chromium plating. After a general treatment of rack making and racking, solution maintenance, and the use of chemical and spectrographic analysis as helpful aids, a colored movie taken by Mr. Logozzo in cooperation with several plants was shown. This film depicted actual operating conditions and not "store-window" displays as is usually the case. It was very well received, and the color added a great deal to the story.

Following a question period, President Logozzo presented a series of slides prepared by A. E. S. SECOND VICE-PRESIDENT C. F. NIXON of the activities of the Society. It was an excellent and well arranged story, which showed the Society in a better light than the previously shown strip film, "Lot's Wife".

GEORGE P. SWIFT, *Secretary*

BRIDGEPORT BRANCH

An honored guest at the Old Timers Night in S. S. Nordan Club on January 6 was MR. GEORGE B. HOGABOOM of New Britain, Conn., A. E. S. first President. Other out-of-town visitors were B. J. GAFFNEY, WALTER LYNCH, JACK BERRY, E. QUINLAN and JACK ENGLISH of New Haven Branch and D. HARTSHORN of New York Branch.

The sixty-two members and guests who attended enjoyed the excellent smorgasbord and refreshments. CHAIRMAN EHRENCRONA then called on GEORGE MORROW, who completely baffled the group with his "magic", and on EUGENE PHILLIPS, RAY O'CONNOR, WILLIAM LINDSAY, JR., GEORGE B. HOGABOOM, WILLIAM FLAHERTY, D. HARTSHORN, C. C. HELMLE and others who told stories or recited poems to everyone's enjoyment.

JOSEPH G. STERLING,
Secretary-Treasurer

BRIDGEPORT BRANCH

Forty-five members and guests were present at the Open Meeting and Educational Session on January 20. TECHNICAL CHAIRMAN RICHARD BARRETT introduced MR. W. A. HELBIG of the Darco Corporation, New York City, as the speaker of the evening. Discussing "Purification of Electroplating Solutions by Filtration and Activated Carbon Treatment", Mr. Helbig pointed out that while activated carbon filtration will remove oils, grease, buffing compounds and other organic impurities, it will not remove metallic impurities. Auxiliary tank should be used in treatment of activated carbon and not the plating tank. The plating solution should be clear before being filtered back into the plating tank. Continuous filtration is better than an occasional treatment since brighteners will be absorbed to a balanced equilibrium.

A lively discussion followed the interesting talk.

JOSEPH G. STERLING,
Secretary-Treasurer

BUFFALO BRANCH

The meeting on February 3 drew a large crowd from outlying districts, who came to hear MR. J. J. WILLIAMS, General Manager of the Talon Company Plant in Meadville, Pa. Mr. Williams held the attention of his audience with his informal comments on the trials and tribulations encountered in the installation of the waste disposal system at the Meadville plant. The scope of the operations was vividly illustrated with slides and laboratory data and left such a strong impression upon the audience that an invitation for a visit to the plant early this summer was wangled.

H. A. FUDEMAN, *Secretary*

CHICAGO BRANCH

The Educational Session and Banquet in the Stevens Hotel on January 14 was one of the best affairs ever arranged by the Branch.

The three afternoon speakers, MR. R. O. HULL of R. O. Hull and Company, Cleveland, Ohio; DR. W. BLUM of the National Bureau of Standards, Washington, D. C.; and DR. B. B. KNAPP of The International Nickel Company, Bayonne, N. J., presented excellent talks on "Factors Affecting Throwing Power", "New Directions in Research", and "New Developments in Nickel Plating", respectively.

About 1,000 members and guests enjoyed the banquet in the evening.

R. F. LEDFORD, *Correspondent*

Chicago Educational Session and Banquet Committee. Front: Paul Salb and J. Andrews; back: M. Longfield, R. Hazucha, J. H. Monaweck, C. Kelly, and R. F. Ledford

The speakers: Mr. R. O. Hull, Dr. W. Blum, and Dr. B. B. Knapp

CINCINNATI BRANCH

The regular January meeting on the 25th was preceded by a dinner at 6:30 P. M.

MR. EZRA A. BLOUNT, Editor of Products Finishing, discussed "Some Fundamental Principles of Electroplating". Starting with fundamental concepts of atoms and molecules and leading up to electricity in plating, Mr. Blount gave a most interesting and instructive lecture. While this information can be found in books, there was much in it for electroplaters who have limited knowledge of the real nature of plating.

PRESIDENT FRED G. BRUNE called for old copies of PLATING for use in the Branch library. Copies of the Branch's proposed by-laws will be sent to all members by CHARLES WISE, Chairman of the By-Laws Committee. There were nineteen present at the dinner, forty-six at the meeting.

H. R. DAVIS, *Secretary*

CINCINNATI BRANCH

The February meeting began with dinner in the Engineering Society Building. A movie titled "White Magic", which proved of special interest to those concerned with painting, explained and illustrated techniques of well known Ohio manufacturing plants in connection with their use of duPont enamels.

The meeting was designated Cincinnati Branch Exhibit Night, and a number of the twenty-one present had brought in plated pieces to be assembled and mounted. These exhibits will become the Branch Exhibit for the national Convention. A reply from the Dayton Branch relative to a joint picnic was favorable.

The refreshments served after the meeting were sponsored by the William Buchanan Supply Company.

H. R. DAVIS, *Secretary*

Chicago Branch Librarian, Dr. J. H. Monaweck, opens the technical session

CLEVELAND BRANCH

A. E. S. SECOND VICE-PRESIDENT C. F. NIXON spoke about "Your American Electroplaters' Society" at the meeting on February 3. Mr. Nixon outlined this year's budget and the scope of the operations of the Society, using lantern slides to show photographs of officers and members participating in A. E. S. programs. He stressed the fact that electroplating has a much larger role in industry than is generally recognized and that the potential for new A. E. S. members and branches is still great, especially in locations distant from present branch cities.

One candidate was elected to membership.

JACK LITTLE, new Chairman of the Annual Dinner-Dance Committee, promised that the event would take place within two months.

HARRY POCHAPSKY, *Secretary*

DAYTON BRANCH

The Fifth Annual Educational Session and Dinner-Dance was a great success due to the wholehearted cooperation of all concerned.

The Honorary Chairman, MR. W. J. NEILL, Columbus Metal Products Company, Columbus, Ohio and A. E. S. First Vice-President, opened the Educational Session, welcomed all present, and introduced the speakers. "Control of Plating Solutions by the Hull Cell" was the subject ably handled by MR. JACK WINTERS, Research Chemist, R. O. Hull Company, Cleveland, Ohio. MR. H. J. MCALEER, President of the Formax Manufacturing

Dancing at the Banquet

Corporation, Detroit, Mich., spoke about "The Inside Story of Buffing Compounds and Buffing Wheels". "Fax Film Method of Comparing Surfaces" was the subject of MR. R. W. COOK, President, Fax Film Corporation, Cleveland, Ohio.

All presentations were of great interest to the guests and members present as evidenced by the discussion and the vote of thanks which followed.

The Dinner-Dance in the evening showed that the planners of this portion of our meeting were not only good technicians but also understand the more pleasant side of life. All of the three hundred and eighty-nine members and friends seemed to have had a really grand time. Thanks are due to the many suppliers for their financial help and the refreshments served.

The "Dayton Trophy" for attendance at Branch meetings was again won by the Columbus Branch. This being the third time, it becomes the permanent possession of the Branch. However, Mr. Neill expressed the willingness of Columbus Branch to continue the award. He also stated that the Toledo Branch is interested and would like to be included as one of the competing Branches.

The "Toulmin Award" for the best paper went to MR. FRED BAUCH of the Dayton Branch for his paper on "Design for Plating".

Two new members were elected.

R. M. CLINEHENS, *Secretary*

DETROIT BRANCH

The meeting on February 3 was conducted by FIRST VICE-PRESIDENT E. A. HAHN in the absence of PRESIDENT C. F. NIXON. There were approximately two hundred members present, a very fine turnout for this season of the year.

Six applicants were elected to membership, bringing the total for the Branch very close to the five hundred mark.

The speaker of the evening was MR. GERALD PAULIN, Chief Metallurgist of the West Leechburg Works of the Allegheny Ludlum Company. Mr. Paulin's subject was "The Finishing of Stainless Steel Strip". He covered it with a great deal of finesse and pointed out the steel mills' position in such operations. The type of finish was said to be of secondary importance as the quality of the finish was determined to a great extent by the gauge of the material purchased, lighter gauge materials generally having the finer finishes. The applications of Type 430 stainless as against Types 301 and 302 was discussed at some length. The largest user of Type 430 is the automobile industry.

The Question and Answer Period lasted approximately a half an hour, believed to be a record length of time; and even after the meeting had adjourned, the speaker was kept busy answering questions. Several questions from the floor could have been very embarrassing, had the speaker been of lesser caliber.

The Detroit Branch is again planning on an Annual Stag Day at the Forest Lake Country Club near Pontiac, Mich. It will be held on Saturday, July 29.

The Committee in charge is headed by WALTER PINNER as Chairman, assisted by FRANK CLIFTON, CHARLIE CONLEY, STAN KRENTEL, RED NEWTON, CLEVE NIXON, DICK SALTONSTALL and FRED WAGNER. This is the same Committee that handled the party last year.

F. J. NEWTON, *Librarian*

HAMILTON BRANCH

Nominations for the executive offices for the coming year were accepted at the February meeting held in the auditorium of Canadian Westinghouse.

VICE-PRESIDENT E. CRANFIELD introduced MR. H. A. FAINT, Sales Manager of Industrial Filter & Pump Company, Chicago, Ill., who then addressed the meeting on the subject of "Filtration in the Plating Room". The speaker dealt with only a few specific phases. With the assistance of sample materials, he described the various types of woven textiles that are used for filter bags, relating the advantages and disadvantages of these cloths in the various types of plating solutions. Several current filter-aid products were described, and samples were displayed to indicate the advantages of each.

Mixtures of filter aid powders were suggested which could be used to advantage for filtering electroplating baths. The members showed keen interest in a new wood-product filter aid powder that is currently being marketed. Development work that has been conducted with several of these materials was described. The most effective procedure to follow when checking troubles in filter pumps and equipment in the shop were included. The discussion period dealt with filtration of zinc cyanide solution and other problems.

G. M. DALTON, *Correspondent*

HARTFORD BRANCH

The meeting on February 20 in Bond Hotel was attended by about fifty members and guests who braved near-zero weather. Preceding the meeting was a movie entitled "The Story of Tin", shown through the courtesy of the Bureau of Mines.

The program consisted of two talks on "Tumbling and Barrel Finishing". MR. G. W. OAKS of the Hartford Steel Ball Company dealt with metals and MR. VERNE VERZIER with plastics.

Mr. Oaks described the uses of the oblique and the horizontal barrels with and without linings. It was brought out that a rubber or neoprene-lined barrel will outlast a wood-lined barrel for certain types of work. Barrels are used to polish (burnish) or smooth (deburr) the metal parts, and polishing is usually preceded by the deburring process. Balls are preferred to stones because of their weight, uniform size, and ease of separation from the work, although stones will do a faster job of deburring on the edges and require less pains in storage as they do not rust.

Mr. Verzier mentioned that the thermoplastic and thermosetting plastics can be tumbled to remove flash, gates, etc., as well as machining and tool marks, and to provide a gloss to the plastic. This can be done wet using abrasive pastes or dry using abrasive impregnated felt, sawdust, corn-cob meal, leather meal, etc.

KERMIT T. SIMONS acted as the technical chairman, and refreshments were served through the courtesy of A. Austin Appley Company.

STANLEY PLATOZ, *Secretary*

INDIANAPOLIS BRANCH

As indicated under Coming Events, elaborate preparations are under way for the Seventh Annual Educational Session and Dinner-Dance to be held on May 6 at the Indianapolis Athletic Club. The following Committee is in charge:

General Chairman—HOWARD PHILLIPS
Arrangements—WILLIAM NIEHAUS, Chairman; R. M. LITTLE, W. W. COTHRAN
Educational Session—ELMER LUNDBERG
Programs and Tickets—MAX MALVASE
Advertising—ROBERT ELLSWORTH
Door Prizes—J. E. VAUGHN
Ticket Sales—ROBERT BRUCK
Entertainment—EDWARD BRUCK
Publicity—D. L. PATRICK

Everyone interested in electroplating and friends of the Indianapolis Branch are cordially invited to attend.

D. L. PATRICK, *Publicity Chairman*

JACKSON-LANSING BRANCH

The January meeting was held on January 10 at the Meadow Lark Inn, Jackson, and started with an excellent dinner furnished by the host, The Murray-Way Corporation of Detroit.

A good-sized group heard MR. E. E. Murray of this company discuss "Flat Polishing" and the new equipment designed for this purpose. Using a combination of belts the operator can obtain almost any finish he desires on a production-line basis.

MESSRS. RALPH "BUD" STRUCK and FRANK ZACCOLA of the Minnesota Mining and Manufacturing Company then gave a talk on "Abrasive Belts Used in Flat Polishing". They also explained the technical service available through their firm.

FRED W. STUCKENBERG,
Publicity Chairman

JACKSON-LANSING BRANCH

In spite of extremely bad weather forty-two members and guests were present at the meeting on February 14 in Hotel Porter, Lansing.

The Haviland Products Company was

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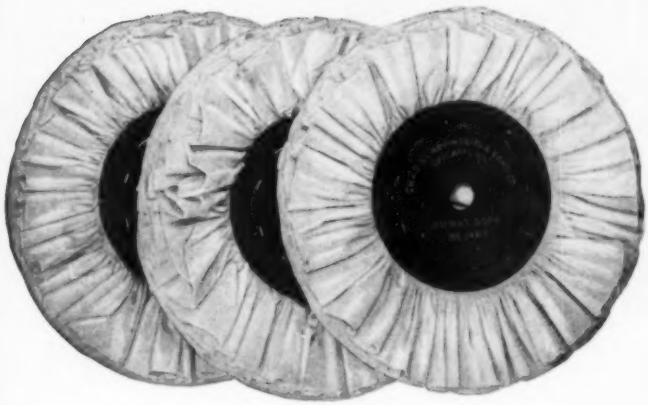

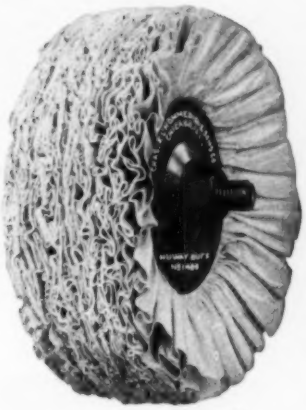

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Branch News

the host of the evening. After a fine dinner Mr. J. M. Haviland, Chief Engineer, gave an excellent talk about the "Chemistry of Metal Cleaning". In his discussion he presented a breakdown of the chemical properties of the ingredients used in most metal cleaners of the acid and alkali types and the reasons for including them.

At the conclusion of the meeting a sound movie entitled "Nickel Refining" was shown.

Fred W. Stuckenberg,
Publicity Chairman

LANCASTER BRANCH

On December 13 the Branch heard a discussion of what is believed to be the greatest advance in chromium plating in twenty years, the new Unichrome High-Speed Self-Maintaining Chromium Bath. It was given by an old friend of the Branch, A. E. S. Past President Frederic Fulforth of United Chromium, Inc. He also discussed chromium plating in general.

Assisting Mr. Fulforth during the question-and-answer period which followed the formal talk was Mr. Henry Mahlsteadt of the same company.

Chester W. Smith,
Secretary-Treasurer

LANCASTER BRANCH

The regular February meeting was held at the Theodore R. Schwalm Watch Dial Manufacturing Company.

The honored guest and speaker for the evening was Dr. H. L. Kellner of the Lea Manufacturing Company. In his talk about polishing and buffing, he discussed the evaluation of finishes in an interesting and novel manner, both bringing out results and demonstrating the practical values of the tests.

President Lester Wagner appointed William Fordney Chairman of the Branch Exhibit Committee and Roland Hoenstine, Charles Snyder and Harry Hovis to serve as a nominating committee.

Following the meeting, refreshments were furnished by Ted Schwalm and Cris Brubaker of C. E. Brubaker and Sons, the host of the evening.

C. W. Smith, *Secretary*

LOS ANGELES BRANCH

The regular January dinner meeting was held on the 11th, fifty-two members attending. One new member was welcomed at this meeting.

Admiral Garten of the U. S. Navy addressed the Branch on "The Progress of Naval Air Power" and showed three interesting films on Naval activities: "The Saga of the Carrier Benjamin Franklin", "Navy Jet Planes", and "Our Naval Strenth in the Pacific".

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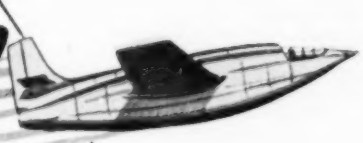

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Branch News

The A. E. S. film on sustaining memberships was then shown and was well received by the members. Following this was a film transcription of the recent television broadcast, "The Electroplating Chemist in Action", sponsored by the Los Angeles Branch. A rising vote of thanks was extended to Messrs. Herold Kroesche, Emmet Holman, and Leon Kadison for their work in preparing this program.

M. H. Orbaugh, *Secretary*

LOS ANGELES BRANCH

Visitors at the regular dinner meeting of February 8 included John Hogan of Baron Industries, John Wickam and D. Miller of Kelite Products, Dr. R. M. Thomas of Rheem Manufacturing Company, Jerome L. Bleiweiss of Coast Paint and Chemical Company, and C. P. Simon of the Barber Webb Company.

H. J. Fonts spoke about "Demineralization of Water for the Plating Room" and prompted a lively discussion.

The death of Adolph Jahnke, a member of the Branch, was reported.

Pete Rodgers gave a brief report on the preparations for the Annual Educational Session and Dinner-Dance.

M. H. Orbaugh, *Secretary*

LOUISVILLE BRANCH

Two items of business were quickly concluded at the meeting on January 19: The Speed Scientific Building of the University of Louisville will continue to be the meeting place; and the subject of the Branch exhibit at the 1950 Convention will be brought up at the next meeting when a chairman of a Branch Exhibits Committee will be appointed.

President Albert Steidle introduced Mr. F. T. Turner of the Osborn Manufacturing Company, who spoke on the subject of "Brushes". The speaker pointed out the advantages in the use of power brushes in finishing recesses, in deburring, and in producing certain types of finishes. Limitations in the use of brushes was also discussed. Appropriate slides supplemented the discussion. It was an excellent presentation of first-hand knowledge of another phase of finishing directly from a representative of a noted supplier.

S. J. Beyer, *Secretary*

LOUISVILLE BRANCH

The regular monthly meeting on February 16 began with a brief discussion of a few items of business, after which Librarian Thomas K. Allison introduced Mr. Robert Palmore, Development Engineer for the American Filter Company, Louisville.

Mr. Palmore addressed the group on a subject on which he is an undisputed authority and in which his company is a foremost leader, namely, "Air Filtration". By means of a long series of slides, he carefully explained the details of construction and operation of the equipment produced by his company. Of particular interest were the details of the rotor in the "Roto-Clone" machines. A number of questions from the floor concluded the meeting.

Stanley J. Beyer, *Secretary*

MELBOURNE BRANCH

The forty-ninth regular meeting of the Melbourne Branch, held in the Metallurgy Theatre of the Melbourne Technical College, was attended by thirty-five members and visitors. Newly elected President George Heid commenced his year of office by announcing proposals discussed at the afternoon committee meeting. These included an improved method of induction of new members and a plan to start meetings at 7:45 P. M. to allow adequate time for the Question Box session.

The technical program consisted of an address by Branch member John Perdrix, Chemist for G. A. Whiting, Mitcham, who spoke about "The Function of *p*H in Electroplating". The speaker defined the term *p*H and, with further definitions of certain of the fundamental concepts in electroplating, showed how changes in acidity and alkalinity could affect the operation of various plating baths. During the discussion attention was drawn to the amazing effect of a buffer in affecting the rate of change of *p*H with acid additions to a nickel bath.

John J. Dale,
Honorary Secretary

MELBOURNE BRANCH

The Fifth Annual General Meeting of the Branch was held on January 19 at the Melbourne Technical College. The Auditor's Report and Balance Sheet showed that the Branch had more than made up the loss incurred in 1948 and was now on a sound financial footing. It was pointed out, however, that because of the recent devaluation of Australian currency, fees may need to be reviewed at the end of 1950.

The election of office bearers for 1950 gave the following results:

President—G. H. Heid
First Vice-President—G. A. Noy
Second Vice-President—R. D. Taylor
Secretary-Treasurer—J. J. Dale
Librarian—H. A. Teague
Board of Managers—G. Walker, H. I. Littauer, G. D. Gow

The retiring President, Keith Leigh, reviewing the past year's activities, was happily able to announce that the Branch Membership has risen from eighty-one to one hundred and one, twenty-eight new members having been admitted. He added that the membership for a city of Melbourne's size should be two hundred and set this figure as a goal for the incoming President. An average attendance of thirty-three was obtained at meetings, four of which were addressed by members of the Branch. Two plant visits held during the year were most successful, about sixty members attending in each case.

The social program, consisting of the Annual Ball and the Annual Dinner, was also very successful, and for this full credit is due to the Social Committee. Concluding his report the President thanked all members of the Branch for their effective support and made special mention of the help given him by the Committee.

Replies on behalf of the members were made by Glen Walker and new President George Heid, both of whom congratulated the retiring President on the results of his term in office.

John J. Dale, *Hon. Secretary*

MONTREAL BRANCH

An open meeting devoted to Branch business was held on January 3 in lieu of the regular educational session. Only thirteen members and guests were present.

First Vice-President J. H. Charles announced that a membership committee has been formed of which he is chairman, the other members being G. R. Davidson, J. T. Reisenburg, and O. Moldenschart. He reported that the Branch increased its membership during the past year.

Considerable discussion took place concerning the duties of the Board of Managers and the Branch Executives. It was voted that the Board of Managers continue to conduct the business of the Branch according to Section 7, Article V of Part II of the By-Laws.

Prospective delegates to the Boston Convention were advised to get in touch with the Secretary as soon as possible.

Copies of the December issue of Products Finishing were distributed; it contained an article about J. H. Feeley's plating shop.

George R. King, *Secretary*

MONTREAL BRANCH

Thirty members and guests were present on February 7 to hear Mr. M. G. Chandell of the Parker Rust Proof Company present a paper on the "Surface Protection of Metals Through the Use of Phosphate Coatings". The paper dealt with the phosphate coating of aluminum and its alloys, zinc and its alloys, and cadmium and steel as a base for paint; iron and steel as a base for oil or wax; as an aid in the deep drawing of metals and in reducing wear on bearing surfaces. The development of phosphate coatings was outlined, from the earliest slow process of immersion of iron and steel articles in phosphoric acid saturated with iron phosphate to the present method of spray bonderizing which makes possible the coating of large objects such as automobiles.

At the end of the talk slides were shown which demonstrated the importance of having the metal surface correctly treated before applying the paint coating. Panels of aluminum, steel, and zinc were passed around, illustrating the difference in paint adhesion between the treated and untreated sections. The members of the audience showed much interest in the descriptive material which was made available by the speaker.

The slide projector and screen were supplied through the courtesy of the R.C.A. Victor Company, Ltd., Montreal.

One Branch member, J. T. Reisenburg, distributed thermometers to those engaged in actual plating.

It was voted that elections of officers be made by letter ballot so that all members will have a vote. The election results will be made known at the March meeting.

The following nominations were made:

President—J. D. Fairbairn, P. M. Coady

First Vice-President—P. M. Coady, J. G. Carrique

Second Vice-President—J. J. Roche

Third Vice-President—R. E. Gordon

Secretary-Treasurer—W. Glover

Librarian—P. Jacques

Board of Managers—J. H. Charles, J. P. Courtemanche, O. Moldenschart, G. Morrissette, G. R. King

George R. King,
Secretary-Treasurer

NEW HAVEN BRANCH

The featured speaker at the monthly meeting on November 8 introduced by Librarian Robert Sammet was Dr. William Stericker of the Philadelphia Quartz Company, Philadelphia, Pa. His subject was "Studies of Alkaline Cleaning of Light Metals". A well known authority on alkali cleaning, Dr. Stericker gave the members a chance to discuss and obtain solutions to their every-day problems of metal cleaning.

Bernard J. Gaffney,
Secretary-Treasurer

NEWARK BRANCH

The regular meeting on January 20 had an attendance of fifty members and guests.

George Wagner, Co-Chairman of the Christmas Party, reported a profit of about $400. One membership application was received. Dr. D. Gardner Foulke was appointed Branch Exhibit Chairman for the Boston Convention. The treasurer was instructed to purchase a $3,000 Government Savings Bond with some of the cash in the treasury. It was suggested that a Ladies' Night or a Technicians' Helpers Night be held next year.

Librarian Robert Ehrhardt introduced the speaker, Dr. E. A. Parker of Technic, Inc., whose subject was "Gold Plating". A very extensive account was given of the different shades of gold-alloy plate used commercially and what is required to produce this great array of hues. Graphs were drawn on the blackboard to show the relationships between color and current efficiencies, gold content in deposits, free cyanide content of bath, etc.

A number of questions were answered by Dr. Parker.

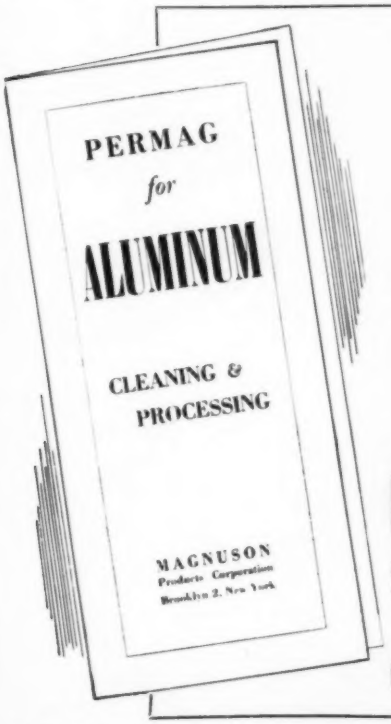
Mynon Diggin had brought a plated clock made in Japan in the form of a bird cage. It led to discussion of plating standards in this country and in Japan.

Samuel S. Frey,
Recording Secretary

PITTSBURGH BRANCH

Approximately forty-five members attended the February meeting.

At the business session which followed the dinner, four men were elected to membership and two applications were received. The Chairman of the By-Laws Revision Committee reported on the proposed changes in the By-Laws, and the Branch voted to accept them and to have the complete By-Laws printed. The Chairman of the Nominating Committee presented his report which included a complete slate of nominations for officers, after which nominations were received from the floor. Further nominations will be made and election of officers will take place in March. The report of the Chairman of the Annual Banquet Committee



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indicated that this Committee is working hard to provide members, their wives and guests with a wonderful evening on April 15.

The speaker for the evening, Mr. M. B. Sternfels, was unavoidably detained. Instead Mr. S. S. Johnston presented the A. E. S. film on Research Committee activities and spoke briefly on the importance of obtaining Sustaining Members.

A round table discussion on various subjects and problems followed. Among the leaders in the discussion were Dr. L. E. Lancy, E. B. Washburn, J. D. Patrick, and R. A. Woofter.

E. J. Smith, *Secretary*

PROVIDENCE-ATTLEBORO BRANCH

Our regular Christmas Party was held on December 12 in the Oakes Tavern in North Providence. Although the group of thirty-two was small for such an affair, an excellent time was had by all.

The regular January meeting was held on the 16th at the Sheraton-Biltmore Hotel. Mr. William Jackson of the Udylite Corporation spoke about "Horizontal Barrel Plating". Stress was laid on the difference in types of equipment and on the various arrangements of that equipment which may be made to minimize solution contamination by dragin and to reduce physical labor to a minimum. Monorails and other crane systems were also discussed. For a complete summary, see The Monthly Review of November, 1946.

Attendance was forty members and guests.

Edward A. Parker, *President*

ROCHESTER BRANCH

January 16 was the date of the first meeting at the new meeting place, The Rochester Institute of Technology. The facilities made available by the school were found ideal for the educational sessions. We are indebted to Member Walter Swanton of the faculty of R. I. T. for making the arrangements.

The Branch started the new year with a clean slate; there was neither any old, nor any new business except election of three candidates for membership.

The Branch was honored to have as its speaker one of its honorary members, Mr. G. A. Lux, who has in the past contributed a great deal of his time to teaching of chemistry and fundamentals of plating to members of the Branch. He is now with The Oakite Products, Inc. Discussing "Some Fundamentals of Electrocleaning", the speaker was true to form in putting his subject matter across. Forty-one members and two guests were present.

Gordon W. MacDonald,
Secretary

SAN FRANCISCO BRANCH

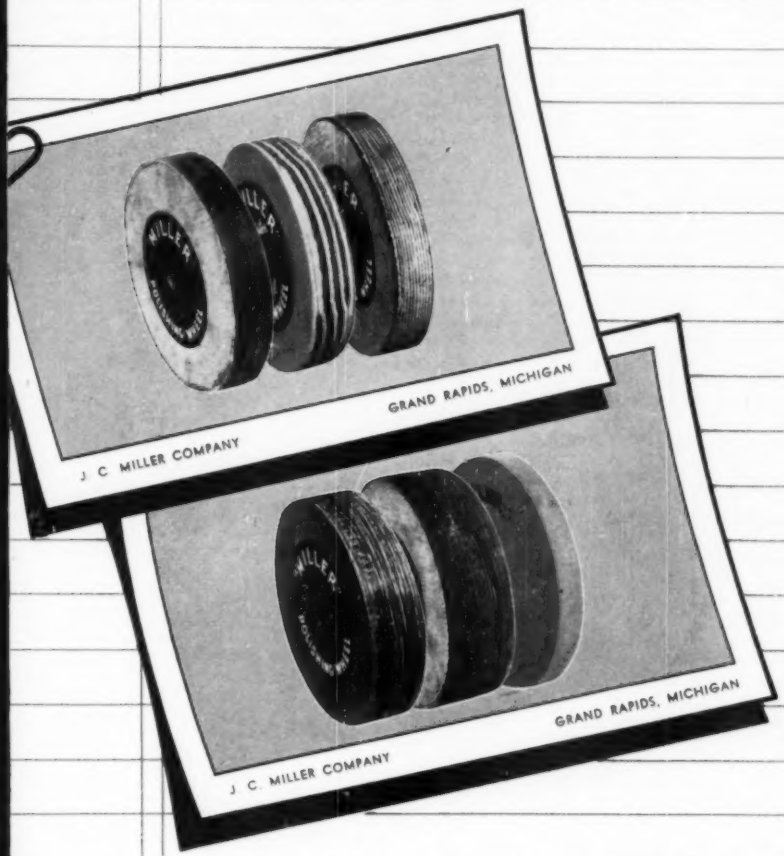
The meeting on January 13 in Oakland had an attendance of nineteen members.

President F. R. Dortt exhorted the Membership Committee to expend a greater effort on the membership drive and appointed Jack Violette the new Committee Chairman.

J. R. Pattenger made his final report on the Christmas Party and Mrs. Pattenger was voted a small token of appreciation for her work with the table decorations.

Mr. Huntington outlined the new program of apprentice training in plating and polishing which is being conducted by the public schools in San Francisco and Oak-

(*Continued on page 429*)



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Membership Report of the A. E. S.

Elections

ALLENTOWN-READING BRANCH: Elmer E. Snyder

BALTIMORE-WASHINGTON BRANCH: Frank X. McNally

BRIDGEPORT BRANCH: Louis W. Evans, Henry Maskowski

CHICAGO BRANCH: Edw. F. Becvar, Marvin P. Daniel, John J. Galanti, A. R. Hatfield, Donald H. Kraft, Irvin R. Patterson, Charles W. Smith, Edw. J. Ziska

CINCINNATI BRANCH: Orloe J. Reed, Robert E. Thompson, Richard W. Schmidt, Donald Vaske, Harold P. Webb, Robert L. Winston

CLEVELAND BRANCH: Charles Bonn

DAYTON BRANCH: Carl L. Austen, Gordon R. Lyons

DETROIT BRANCH: A. Baldini, King Clifford, E. M. Czekas, J. S. Foley, V. J. Gach, R. C. Schacht

HARTFORD BRANCH: Charles W. Bennett, John H. Zuffelato

JACKSON-LANSING BRANCH: Russell Fay, R. C. Taylor

MELBOURNE BRANCH: K. Alexander, L. E. Chambers, A. Ford, J. L. Fraser, G. S. Haines, W. H. Hawley, A. G. Highland, A. I. Lancaster, J. V. McCarthy, J. V. Polglase

MILWAUKEE BRANCH: Albert J. Hermansen, William H. Horder, Edw. H. Kielpinski, Edw. J. Wroblewski

NEWARK BRANCH: Adolph Schall, August Mendizza

NEW YORK BRANCH: Milton Gelfand, Ralph A. Heiss, Josiah M. Kane, Arthur F. Wood, Joseph Wozny

PITTSBURGH BRANCH: Arthur H. Bauman, Prescott R. Carr, Charles A. Forbes, Laurance W. Lord

PROVIDENCE-ATTLEBORO BRANCH: H. Leslie Ferguson, Herbert G. Nerjes

SOUTHEASTERN BRANCH: George E. Farrar, Cratus O. Leonard, Jr.

TWIN CITY BRANCH: L. N. Gushard, Henry K. Makino, W. T. Thomson

MEMBERSHIP-AT-LARGE: Rudolf Kopec

Reinstatements

BOSTON BRANCH: Mortimer Bloom

NEWARK BRANCH: Raymond Housel, Edw. Hackenberg

MEMBER-AT-LARGE: A. M. Spoorenberg

Transfers

Mortimer Bloom from Boston Branch to Baltimore-Washington Branch; Manuel de La Torre Diaz from Bridgeport Branch to Membership-at-Large; I. M. Weiss from Detroit Branch; Harold W.

Membership Competition

BRANCH	Membership April 1, 1949*	New Members	Net Change in Membership	Per Cent Net Change
FIRST GROUP				
DETROIT	427	85	+64	+15.0
NEW YORK	265	32	+22½	+ 8.5
PITTSBURGH	135	26	+ 7½	+ 5.6
HARTFORD	133	13	+ 7	+ 5.3
CLEVELAND	186	21	+ 6	+ 3.2
PHILADELPHIA	187	17	+ 3	+ 1.6
GRAND RAPIDS†	160	..	..	..
BRIDGEPORT	160	8	− 2	− 1.3
CHICAGO	391	31	−14½	− 3.7
MILWAUKEE	132	15	− 7	− 5.3
LOS ANGELES	217	18	−12	− 5.5
BOSTON	153	10	− 8½	− 5.6
NEWARK	256	22	−15	− 5.9
TORONTO	154	10	−16½	−10.7
SECOND GROUP				
MELBOURNE	81	34	+24	+29.6
CINCINNATI	90	15	+13½	+15.0
BUFFALO	82	6	+ 6½	+ 7.9
WATERBURY	122	7	+ 2½	+ 2.0
SYRACUSE	83	7	+ 1½	+ 1.9
PROV.-ATTLEBORO	109	5	+ 2	+ 1.8
BALTIMORE-WASH.	83	8	+ 1	+ 1.2
SYDNEY†	108	8	+ 1	+ 0.9
INDIANAPOLIS	104	11	..	..
DAYTON	98	5	− 3½	− 3.6
NEW HAVEN	108	3	− 4½	− 4.2
ST. LOUIS	107	14	−10	− 9.3
ROCHESTER	125	..	−20½	−16.4
ST. JOSEPH VALLEY	80	5	−14	−17.5
THIRD GROUP				
SOUTHEASTERN	38	18	+12½	+32.9
COLUMBUS	38	14	+ 9½	+25.0
LOUISVILLE	20	6	+ 4½	+22.5
ROCKFORD	56	8	+ 8	+14.3
SPRINGFIELD	50	2	+ 2	+ 4.0
LANCASTER	59	5	+ 2	+ 3.4
JACKSON-LANSING	59	5	− 1½	− 2.5
MONTREAL	69	10	− 2	− 2.9
SAGINAW VALLEY†	67	6	− 3	− 4.5
TWIN CITY	77	7	− 6	− 7.8
ADELAIDE	76	4	− 8	−10.5
SAN FRANCISCO	71	19	− 8	−11.3
TOLEDO	56	2	− 6½	−11.6
ALLENTOWN-READING	43	2	− 9½	−22.1
OUTSIDE COMPETITION				
HAMILTON	..	17	+23	..
WESTERN ONTARIO	..	19	+23	..
AT LARGE	100	26	+ 7	..
IN TRANSFER	22	..	− 1	..
TOTAL A. E. S.	5,237	604	+60	+ 1.1

Active Membership, March 1, 1950 5,297

*Subject to correction. †Winners of membership competition in 1948-1949.

Dow from Jackson-Lansing Branch; Raymond Housel from Newark Branch; James Shaw to Providence-Attleboro Branch

Resignations

DETROIT BRANCH: B. D. Thomas
MELBOURNE BRANCH: F. H. Chapman, J. Doidge, J. J. Kavanagh, J. E. Kannan, G. Miller

Suspensions

DETROIT BRANCH: P. Amundson, C. W. Dodd, D. L. Hancotte, Jr., H. Stone, W. J. Tafel
LANCASTER BRANCH: Lloyd M. Schaeffer, J. Luther Snyder
NEWARK BRANCH: Emmet J. Ryan, Thomas H. Schlipf
MEMBERSHIP-AT-LARGE: T. L. de Jager

Deaths

LOS ANGELES BRANCH: Adolph Jehnke
TWIN CITY BRANCH: Edw. O. Granoien

New Sustaining Members

A number of firms, interested in supporting the research work of the Society, have joined the ranks of sustaining members since the beginning of the recently inaugurated campaign. At the time of this writing, they are:

Apollo Metal Works, Chicago, Ill.
Arrow Plating Company, Chicago, Ill.
Bendix Products Division, South Bend, Ind.
Briggs Manufacturing Company, Detroit, Mich.
Detroit Plating Industries, Detroit, Mich.
Diversey Corporation, The, Chicago, Ill.
Grand Plating Company, Chicago, Ill.
Keeler Brass Company, Grand Rapids, Mich.
Kelite Products, Inc., Los Angeles, Calif.
Knight-Morley Corporation, Detroit, Mich.
Lyon, Incorporated, Detroit, Mich.
R. C. Mahoney, Detroit, Mich.
Mercil Plating Equipment Corporation, Chicago, Ill.
National Plating Company, The, Chicago, Ill.
Nelson Chemicals Corporation, Detroit, Mich.
Studebaker Corporation, The, South Bend, Ind.
Turco Products, Inc., Los Angeles, Calif.
United Manufacturing Company, Chicago, Ill.

These companies have set a good example for those who wish to offer tangible proof of their solicitude for the welfare of the plating industry.

Branch News

(*Continued from page 426*)

land and strongly urged shop owners to get behind it and see that their trainees attend.

JOHN J. MEEHAN, *Secretary*

ST. JOSEPH VALLEY BRANCH

Despite extremely hazardous road conditions due to sleet, fifteen members were present for the dinner and social hour and twenty-one attended the technical session on January 4.

After one applicant had been elected to membership, PRESIDENT RALPH WYSONG stressed the importance of the membership drive.

The Chairman of the Research Finance Committee, DR. HAROLD WIESNER, indicated some progress in getting sustaining memberships in the St. Joseph Valley area. The Branch voted that a $1.00 fee per member be collected for the Research Fund with the regular yearly dues.

The following Nominating Committee was appointed: JIM HEDGES, KENNETH HARLAN, and JOHN LOCKERBIE.

The speaker for the evening was MR. C. H. SAMPLE of The International Nickel Company, New York City. His lecture on "Corrosion Behavior and Protective Value of Electroplated Coatings" was illustrated with colored slides of corroded panels with cadmium and zinc, lead, and copper-nickel and chromium deposits. Of particular interest was the comparison of the New York City exposures with those at Kure Beach, N. C., and at Pennsylvania State College. The variation of test results in different atmospheric exposures in salt spray test, and in humidity tests were extremely educational. Mr. Sample stressed the fact that environment and thickness are of greatest importance and warned that it is easy to become misled in the interpretation of accelerated test results.

EUGENE ROTH, *Secretary-Treasurer*

ST. LOUIS BRANCH

There were thirty-two members present for the dinner and thirty-seven members for the meeting on January 11.

After the President had announced that the business of the evening would be kept as short as possible because three plating organizations were holding meetings the same night, LIBRARIAN DAVIES introduced MR. R. F. LEDFORD of the Hanson-Van Winkle-Munning Company, who gave a very interesting talk about "Periodic Reverse Plating". Three new applicants for membership were accepted.

EDWARD HUNLETH, *Secretary*

ST. LOUIS BRANCH

Thirty-five members enjoyed the dinner at the meeting on February 8. The business of the evening turned out to be a discussion on the Branch allowing the speaker of the evening to treat the members to refreshments, which Mr. Robins thought a gross imposition to expect of a speaker. The question will be taken up at the next Board of Managers' meeting.

LIBRARIAN L. A. DAVIES introduced MR. JOHN DAVIS of the Udylite Corporation, Detroit, Mich. His talk on automatic plating was augmented by color film.

EDWARD HUNLETH,
Secretary-Treasurer

SOUTHEASTERN BRANCH

A. E. S. PAST PRESIDENT S. S. JOHNSTON of Weirton Steel Company was the featured speaker at the meeting on January 13.

There was quite a delay, because Mr. Johnston's plane had set him down in Macon, Ga., and he had to finish his trip by bus. The twenty-six members and guests, however, were rewarded by a very impressive program: slide pictures of the A. E. S. at work and a motion picture entitled "Miles of Steel". The Branch is deeply grateful for Mr. Johnston's efforts in its behalf.

WM. T. WEYMOUTH,
Secretary-Treasurer

SYRACUSE BRANCH

The Entertainment Committee provided a fine sound and color movie entitled, "The Shortest Way Home", courtesy Greyhound Lines, Inc., to open the meeting on February 20.

The speaker for the educational session was MR. ARTHUR KOEHLER, Chief Chemist, Frederick Gumm Chemical Company. His topic was "Barrel Burnishing and Deburring" and he covered the types of finish which could be obtained on various metals, the mechanics of the burnishing action, the selection of proper compound and steel shot, and the proper care of steel shot while in storage.

After a question and answer period, all enjoyed the refreshments provided by MR. EDWARD HOLLISTER of the Frederick Gumm Chemical Company.

Attendance was twenty-one.

K. S. PARNELL,
Secretary-Treasurer

TWIN CITY BRANCH

There were thirty persons present at the meeting on February 6.

Following dinner, PRESIDENT CLIFFORD A. BOWMAN introduced seven guests. Three new members were elected at the business session.

BRANCH LIBRARIAN GUNNAR DEEDON introduced MR. HOWARD J. MCALEER, President of Formax Manufacturing Company, Detroit, Mich., who told "The Inside Story of Buffing Compositions and Wheels". It was a most interesting talk, and considerable interest was aroused.

ROBERT L. BUCKLEY,
Secretary-Treasurer

Directory of A. E. S. Officers and Research Chairman Branch Secretaries and Research Chairmen

A. E. S. OFFICERS

President.....A. W. LOGOZZO
Nutmeg Chrome Corporation
79 Chapel Street, Hartford 3, Conn.

First Vice-President.....W. J. NEILL
Columbus Metal Products, Inc.
1341 Norton Avenue, Columbus 12, Ohio

Second Vice-President.....C. F. NIXON
Ternstedt Division, G. M. C.
6307 W. Fort Street, Detroit 9, Mich.

Third Vice-President.....F. J. MacSTOKER
25 Princeton St., Garden City, N. Y.

Past President.....S. S. JOHNSTON
Weirton Steel Company, Weirton, W. Va.

Executive Secretary.....A. K. GRAHAM
P. O. Box 168, Jenkintown, Pa.

A. E. S. RESEARCH COMMITTEE

Chairman.....W. M. TUCKER
Eastman Kodak Company, Rochester 4, N. Y.

Secretary.....The Executive Secretary

LOCAL BRANCHES

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Address G.P.O. Box 598E, Adelaide, S. A., Australia.

ALLENTOWN-READING meets third Wednesday of each month in Spurgeon's Hotel, Allentown, Pa. Secretary-Treasurer, James F. Riegel, 425 S. 18th Street, Allentown, Pa. Research Finance Committee Chairman, G. W. Ward, 212 N. 6th Street, Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of October, December, February, and April in Baltimore at the Engineers' Club, and of November, January, March, and May in Washington, D. C., at the Garden House, Dodge Hotel. Secretary, Vernon A. Lamb, National Bureau of Standards, Washington 25, D. C.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown, 72, Mass. Research Finance Committee Chairman, Eugene P. Carter, c/o United Carr Fastener Corporation, 81 Ames Street, Cambridge, Mass.

BRIDGEPORT meets first and third Friday of each month in Barnum Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony Street, Bridgeport 8, Conn. Research Finance Committee Chairman, Carl Schaefer, c/o Casco Products Corporation, 512 Hancock Avenue, Bridgeport 5, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary, H. A. Fudeman, 534 W. Ferry Street, Buffalo 13, N. Y. Research Finance Committee Chairman, B. P. Fortin, 200 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 8 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, J. M. Andrus, 3701 Ravenswood Avenue, Chicago 13, Ill. Research Finance Committee Chairman, Clyde Kelly, 740 W. Englewood, Chicago 21, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary-Treasurer, H. Roper Davis, 6005 Yosemite Drive, Cincinnati 12, Ohio.

CLEVELAND meets first Friday of each month in Cleveland Hotel at 8 P. M. Secretary-Treasurer, Harry Pochapsky, 24961 Euclid Avenue, Cleveland, Ohio. Research Finance Committee Chairman, E. C. Friedl, c/o du Pont Company, 1335 Guardian Building, Cleveland 14, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, Nathan L. Koslin, 2641 Cleveland Avenue, Columbus 11, Ohio

DAYTON meets first Friday of each month in Engineers Club. Secretary, Richard M. Clinchens, 701 W. Stewart Street, Dayton 8, Ohio. Research Finance Committee Chairman, C. W. Powell, 3112 Princeton Drive, Dayton 6, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, F. L. Clifton, 16536 Inverness, Detroit 21, Mich. Research Finance Committee Chairman, W. B. Knight, c/o Knight Plating Company, 3143 Bellevue Avenue, Detroit 11, Mich.

GRAND RAPIDS meets second Friday of each month at 7:30 P. M. in Rowe Hotel. Secretary, F. J. Darling, 3366 College Avenue, N. E., Grand Rapids, Mich. Research Finance Committee Chairman, John W. Putte, 308 Gladstone Avenue, S. E., Grand Rapids, Mich.

HAMILTON BRANCH. Secretary, William G. Finlay, c/o The M. & Y. Products Limited, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 Washington Street. Secretary, H. Smith, 335 Whittier Place, Indianapolis, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Hayes Hotel in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, E. F. Strefling, 1423 Kelsey Avenue, Lansing 10, Mich.

LANCASTER meets second Friday of each month at 8 P. M. in Thaddeus Stevens Industrial School. Secretary-Treasurer, Chester W. Smith, c/o Superior Metal Company, Bethlehem, Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway West, Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Scully's Restaurant. Secretary, Myron H. Orbaugh, c/o Bone Engineering & Tool Company, 701 W. Broadway, Glendale 4, Calif.

LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Louisville. Secretary-Treasurer, Stanley J. Beyer, c/o Hart Products, 915 E. Kentucky Street, Louisville 4, Ky. Research Finance Committee Chairman, Garland Logsdon, 1519 Central Avenue, Louisville, Ky.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Hon. Secretary-Treasurer, John J. Dale, c/o Defense Research Laboratories, Maribyrnong, Victoria, Australia.

MILWAUKEE meets first Friday of each month in Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, Harry J. Krueger, Route 7, Box 224, Wauwatosa 13, Wis. Research Finance Committee Chairman, James Paulson.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary-Treasurer, George R. King, P. O. Box 29, Montreal 30, Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets first and third Friday of each month at 8 P. M. in Hotel Robert Treet. Secretary-Treasurer, George Wagner, 1130 S. Long Avenue, Hillside, N. J. Research Finance Committee Chairman, Edwin Bowerman, 166-41 17th Avenue, Whitestone, N. Y.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Spring Glen, Hamden 14, Conn. Research Finance Committee Chairman, Dr. H. L. Kellner, c/o Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 86, Conn.

NEW YORK meets second and fourth Fridays of each month in Statler Hotel. Secretary-Treasurer, Franklyn MacStoker, 25 Princeton Street, Garden City, L. I., N. Y. Research Finance Committee Chairman, George F. Hermann, 52 Chestnut Street, Brooklyn 8, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, Al Hirsch, 1945 W. Airdrie Street, Philadelphia 40, Pa.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary-Treasurer, E. J. Smith, Chem. Dev. & Res. Lab., Weirton Steel Co. Weirton, W. Va Research Finance Committee Chairman, R. A. Woofter, 42 Hiland Ave., Emsworth, Pittsburgh 2, Pa.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence-Biltmore Hotel. Secretary, Frank W. Boothroyd, 51 Barber Ave., Apponaug, R. I. Research Finance Committee Chairman, Pierre B. Lousbury, 78 North Ave., Attleboro, Mass.

ROCHESTER meets third Monday of each month in Ukranian-American Club. Secretary, Gordon W. MacDonald, North Bergen Road, R. D. No. 1, Bergen, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

ROCKFORD meets second Monday of each month in Faust Hotel. Secretary, Vern T. Wissen, Spring Creek Road, Rockford, Ill. Research Finance Committee Chairman, Al Overbie, c/o National Lock Company, Rockford, Ill.

KOCOUR

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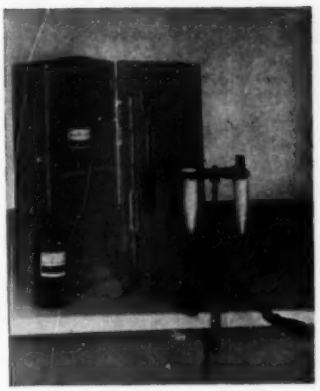

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SAGINAW VALLEY meets for dinner at 7:00 P. M. and meeting at 8:00 P. M. at Rollie McNivens, Frankenmuth, Mich., second Wednesday of each month, September through May. Secretary-Treasurer, R. A. Nyquist, c/o Bay Manufacturing Division, Morton Street, Bay City, Mich.

ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 1720 Mishawaka Avenue, South Bend 15, Ind. Research Finance Committee Chairman, Ray Friend, 1435 Howard Street, Niles, Mich.

ST. LOUIS meets second Wednesday of each month in York Hotel. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, H. Siegel, c/o Siegel-Roberts Plating Company, 4193 Manchester Avenue, St. Louis, Mo.

SAN FRANCISCO meets second Thursday of each month, alternating between El Jardin Restaurant, 22 California Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, John J. Meehan, 1345 16th Avenue, Apt. 4, San Francisco, Calif.

SOUTHEASTERN meets second Friday of each month in Robert Fulton Hotel, Atlanta, Ga. Secretary, William Weymouth, 173 Clay Street, S. E., Atlanta, Ga. Research Finance Committee Chairman, Dr. Fred W. Cox, Engineering Experiment Station, Georgia School of Technology, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Secretary, James Laing, 93 Woodbridge Street, South Hadley, Mass. Research Finance Committee Chairman, James Laing, c/o Van Valkenburg Company, Montgomery Street, Willamansett, Mass.

SYDNEY, AUSTRALIA. Secretary-Treasurer, T. O. Kolts, 7 King Street, Newtown, Sydney, N. S. W., Australia.

SYRACUSE meets third Monday of each month in Hotel Syracuse. Secretary, Kenneth Parnell, c/o Brown-Lipe-Chapin Division, General Motors Corporation, Syracuse, N. Y. Research Finance Committee Chairman, George W. Cavanaugh, 129 Kenwood Avenue, Syracuse, N. Y.

TOLEDO meets first Thursday of each month at Commodore Perry Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio. Research Finance Committee Chairman, William Russell, 7th Street at Dixie Highway, Perrysburg, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, R. Stevens, c/o Bryden Brass Company, 927 Dufferin Street, Toronto, Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Canada.

TWIN CITY meets first Monday of each month, October through June, in Covered Wagon Cafe, Lodge Room, 114 S. 4th Street, Minneapolis. Secretary-Treasurer, Robert L. Buckley, 316 Builders Exchange, Minneapolis 2, Minn. Research Finance Committee Chairman, Gunnar Deedon, 3650 47th Avenue S., Minneapolis, Minn.

WATERBURY meets second Friday of each month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Dr. B, Cheshire, Conn. Research Finance Committee Chairman, Anthony Maz, c/o Risdon Manufacturing Company, Waterbury, Conn.

WESTERN ONTARIO meets third Friday of each month in William Pitt Hotel, Chatham, Ontario. Secretary-Treasurer, D. E. Paton, c/o Sydenham Trading Company, Ltd., Wallaceburg, Ontario, Canada.

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plating

April 1, 1950

Dear Reader:

From time to time we receive inquiries about the plating industry: number of plants, number of men employed, number of foremen, dollar volume of supplies sold, etc. Because there are few reliable statistics, we usually have to make "educated" guesses.

In a few specialized fields, however, some data are available.

Thus it has been reliably estimated, by W. M. Phillips of General Motors Research Laboratories, that the auto industry has an investment of about $170,000,000 in plating plant and equipment, exclusive of the value of buildings. On the basis of 6 million cars per year, the value of the plating exceeds $300,000,000 annually. Not less than 34,000 men are employed to carry out these activities. The average plated area is 50 square feet per car, and the total area of last year's cars plated with chromium alone would provide a ribbon one yard wide stretching around the earth at the equator.

In the tin plate industry, according to S. S. Johnston of the Weirton Steel Company, not less than 2½ million tons of steel—enough to build 28 ocean liners of the size of Queen Mary—are rolled annually into 10,000,000,000 sq. ft. of strip steel for electrotin plate, 85 per cent of which go into food packs. This tin plate would provide a metal curtain 170 feet in height completely surrounding the United States.

Sincerely,

Gustaf Soderberg

Future Meetings

NATIONAL PRODUCTION EXPOSITION of the Chicago Technical Societies Council in Stevens Hotel, April 4–8, 1:00–10:00 P. M.

PITTSBURGH BRANCH, A. E. S. Annual Banquet in Sheraton Hotel on April 15 at 6:30 P. M.

THE ELECTROCHEMICAL SOCIETY, 97th Meeting in Statler Hotel, Cleveland, Ohio, on April 19–22.

ELECTRODEPOSITORS' TECHNICAL SOCIETY Silver Jubilee and Annual Conference in Grand Hotel, Eastbourne, England on April 19–22.

MILWAUKEE BRANCH, A. E. S. Annual Educational Session (2:00 P. M.) and Banquet (evening) in Schroeder Hotel on April 27.

NEW ENGLAND REGIONAL MEETING, A. E. S., sponsored by New Haven, Boston, Hartford, Springfield and Waterbury Branches in Hartford Club, Hartford, Conn., on May 6. Educational Session at 2:30 P. M., banquet in the evening.

TORONTO BRANCH, A. E. S. Annual Regional Meeting in General Brock Hotel, Niagara Falls, Ont., on May 6. Technical session in the afternoon, banquet in the evening.

INDIANAPOLIS BRANCH, A. E. S. Annual Educational Session and Dinner-Dance in Indianapolis Athletic Club on May 6.

AMERICAN ELECTROPLATERS' SOCIETY 37th Annual Convention and the 4th International Conference on Electrodeposition in Statler Hotel, Boston, Mass., on June 12–15.

AMERICAN SOCIETY FOR TESTING MATERIALS 53rd Annual Meeting and 9th Exhibit of Testing Apparatus and Related Equipment in Chalfonte-Haddon Hall, Atlantic City, N. J., on June 26–30.

DETROIT BRANCH, A. E. S. Annual Stag Day at Forest Lake Country Club near Pontiac, Mich., on July 29.

INDUSTRIAL FINISHES EXHIBITION at Earle Court, Kensington, London, England on August 30–September 7.

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1—1000A., 15 V. Gen. Elec.
1— 300 A., 15 V. Star
1— 750 A.,20 V. M. G. Corp.
1— 800 A., 22.33 V. Gen. Elec.

24 VOLTS
2—1500 A. Century
1—2500 A. Gen. Elec.
2—3000 A. Electric Products

1— 600 A., 24 V. Reliance
1— 200 A., 25 V. Star
1— 300 A., 25 V. Star
1— 175 A., 25 V. Cr. Wh.

32 to 60 VOLTS
1— 500 A., 32 V. Columbia
2— 100 A., 30 V. Gen. Elec.
1— 200 A., 30 V. West.
2— 200 A., 32 V. Gen. Elec.
2—1500 A., 32/40 V. Century
1—1000 A., 33 V. Gen. Elec.
2— 500 A., 40 V. Chandeysson
2—1000 A., 40 V. Chandeysson
2— 200 A., 48 V. Gen. Elec.
3—1500 A., 45 V. Century
1—1500 A., 50 V. Gen. Elec.
2— 800 A., 50 V. Gen. Elec.
1— 400 A., 50 V. Gen. Elec.
6—1500 A., 50 V. Century
1—1000 A., 60 V. Gen. Elec.

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Yes, you can buy imitation compounds. But if you want Lea Quality backed by Lea Technical service, be sure that the circular Lea Trademark is back of what you buy whether greaseless Lea Compound or "no free grease" Learok.

CORRECTION

In the Lea Mfg. Co.'s advertisement on the front cover of the February issue of Metal Finishing there was unfortunately an error in one of the figures used in connection with the LECTROMAG, a portable instrument for measuring plating thickness. The advertisement read: "non-magnetic coatings on carbon steel or iron ranging from 0.0002 to 0.0009 inches are measurable with the following accuracies: plus or minus 10% for thicknesses 0.001 inches and over; plus or minus 15% for thicknesses under 0.001 inches." The above range should have read: "from 0.0002 to 0.008 inches."

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